

ಕರ್ನಾಟಕ ಸರ್ಕಾರ

GOVERNMENT OF KARNATAKA

ಕಾಲೇಜು ಮತ್ತು ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ಇಲಾಖೆ

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

C-20
2020-21

Diploma in Electrical & Electronics Engineering



With Effect from 2020-21

C-20

**Curriculum Development
Cell**

**Department of Collegiate &
Technical Education**

Vision





[(To be drafted individually at institution level)]

Create globally competent Electrical and Electronics Engineering Technologists to excel their skills in Electrical and Electronics Engineering

Mission

(To be drafted individually at institution level)

The mission of the Electrical & Electronics Engineering Program is to benefit the society at large by

-  **M1:** *Provide the environment where industry oriented education is imparted through systematic teaching and learning process in interaction with industry and alumni.*
-  **M2:** *Develop value based system of education by offering well-balanced programme of instruction.*
-  **M3:** *Develop practical experience and giving opportunities for overall personality development.*
-  **M4:** *Create life-long learning by enhancing the knowledge base and skills necessary to contribute to the improvement of their profession and community*

Programme Educational Objectives (PEOs)

(To be drafted individually at institution level)

(After 2/3 years of graduation, the students will have the ability to)

PEO1	To excel in Electrical and Electronics Engineering field and apply the knowledge in diverse fields that requires professional skills.
PEO2	To contribute Electrical and Electronics Engineering skills in the field ethically.
PEO3	To promote students pursue professional development, entrepreneurship and continuing education for their career growth and create enthusiasm for life-long learning.

PROGRAM OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

CONSISTENCY MATRIX OF PEO'S WITH MISSION

	PEO statements	Adapt to Industry	Higher Learning	Team Spirit	Self-Learning	Leadership Qualities	Societal Needs	Environmental Concern
1	To excel in Electrical and Electronics Engineering field and apply the knowledge in diverse fields that requires professional skills.	3	3		3			
2	To contribute Electrical and Electronics Engineering skills in the field ethically.			3	3			
3	Topromote students pursue professional development, entrepreneurship and continuing education for their career growth and create enthusiasm for life-long learning.						3	3

PROGRAM SPECIFIC OUTCOMES (PSOs)

Program shall specify 2-4 Program Specific Outcomes
(To be drafted individually at institution level)

PSO1	Design and simulate basic electronic circuits and make use of the measuring instruments in the design of analog and digital circuits
PSO2	Apply principles of mathematics, signals and communication theory to analyze different types of signals and operations on signals.

1.0 GENERAL PROGRAMME STRUCTURE AND CREDIT DISTRIBUTION

1. **Definition of Credit:** Credit is a kind of weightage given to the contact hours to teach the prescribed syllabus, which is in a modular form. For courses, one credit is allocated to one contact hour for theory / tutorial per week and one credit is allocated to 02 contact hours for practical.
2. **Choice-Based Credit System (CBCS):** CBCS is a flexible system of learning that permits students to learn at their own pace, choose electives from a wide range of elective courses and adopt an inter-disciplinary approach in learning and make best use of the expertise of available faculty.

3. Range of Credits

1 Hr. Lecture (L) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
1 Hr. Tutorial (T) per week	1 credit
4 Hrs. Theory (T) per week	4 credit
3 Hrs. Practical (P) per week [1 Hr. Tutorial +2 Hrs. Practical]	2 credit

4. **Programme:** Programme means Diploma Programme that is Diploma in Electrical & Electronics Engineering, which is of three years duration.

2.0 PROGRAMME STRUCTURE

- Course:** A Course is a component (a paper) of a Programme. All the courses need not carry same weightage. The course should define Course objectives. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ Internships / seminar or a combination of these, to meet effectively the teaching and learning needs and the credits may be assigned suitably.
- Course Code:** Each course shall have an alphanumeric code, which includes last two digits of year of introduction such as 20 subject code EE (ME for Electrical & Electronics engineering, CH for Chemical Engineering etc.), then first two digits for example 12 (where 1 represents first semester and 2 represents the course number in incremental order) and the last alphabet represent Theory (T), Practical/Internship/Project (P), Drawing (D), Programme / Open Electives (A, B, C, E, F, G ...).
- Programme Courses:** Each Programme will consist of Communication skills and Social Sciences (HS), Engineering Mathematics, Statistics and Analytics (BS), Engineering Sciences (ES), Professional Core (PC), Professional Electives (PE), Open Electives (OE), Employability Enhancement Courses (EEC) and Internships.
 - Communication Skills and Social Sciences:** Communication Skills and Social Science courses are incorporated in the curriculum to meet the desired needs of communication and life skills amongst students.
 - Engineering Mathematics, Statistics and Analytics:** Common to all Engineering Programme to develop reasoning and analytical skills amongst students.
 - Engineering Sciences:** Engineering Science shall create awareness on different specializations of engineering studies. The goal of these courses are to create engineers of tomorrow, who possess the knowledge of all disciplines and can apply their

interdisciplinary knowledge in every aspect. It could be any branch of engineering - Civil, Computer Science and Engineering, Electrical, Mechanical, etc.

4. **Professional Core:** Core Courses designed in the programme which are major courses of the discipline, required to attain desired outcomes and to ignite critical thinking skills amongst students.
5. **Professional Elective:** Generally a course can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline or nurtures the candidate's proficiency/skill is called Professional Elective Course.
6. **Open Electives:** An elective course chosen generally from other discipline/ subject, with an intention to seek interdisciplinary exposure is called an open elective. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents of which are similar to that of their departmental core/elective courses.
7. **Audit / Non-Core Courses:** An audit / Non-core course is one in which the student attends classes, does the necessary assignments, and takes exams. The Institute encourages students towards extra learning by auditing for additional number of courses. The results of audit courses shall not be considered for prescribed "carry over courses" limit, however students need to pass audit courses for awarding the diploma.
8. **Employability Enhancement Courses:** It contains the following courses:
 - a. **Mini Project:** Mini Project is a laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small systems/application.
 - b. **Seminar:** Seminar should be based on thrust areas in state of art technologies. Students should identify the topic of seminar and finalize in consultation with Guide. Students should understand the topic and compile the report in standard format and present in front of Panel of Examiners respective Programme.
 - c. **Major Project:** Every student must do one major project in the Final year of their program. The minimum duration of project is 6 months. Students can do their major project in Industry or R&D Lab or in house or combination of any two.

3.0 COURSE CODE AND DEFINITION:

Course code	Definitions	Teaching Dept. Code	Name of the Teaching Department	Teaching Dept. Code	Name of the Teaching Department
L	Lecture	SC	Science	MI	Mechanical Engineering [Instruments]
T	Tutorial	CP	Commercial Practice / English	CR	Ceramic Engineering
P	Practical	ME	Mechanical Engineering	EN	Civil Environmental Engg.
HS	Humanities & Social Sciences Courses	EE	Electrical & Electronics Engg.	AN	Aeronautical Engg.
BS	Basic Science Courses	CE	Civil Engineering	MN	Mining & Mine Surveying
ES	Engineering Science Courses	EC	Electronics & Commn. Engg.	MM	Modern Office Management
PC	Program Core Courses	CS	Comp Science & Engg.	LI	Library and Information Science
PE	Program Elective Courses	IS	Info Science & Engg.	FT	Apparel Design and Fabrication Technology
OE	Open Elective Courses	AT	Automobile Engg.	CH	Chemical Engineering
AU	Audit Courses	MC	Mechatronics	PO	Polymer Technology
SI	Summer Internship	MT	Metallurgical Engg.	PT	Printing Technology
PR	Project	HP	Mechanical Engineering [HPT]	TX	Textile Technology
SE	Seminar	WS	Mechanical Engineering [Welding & Sheet Metal]	EI	Electronic Instrumentation & Control Engg.
CIE	Continuous Internal Evaluation	CN	Cinematography	LT	Leather & Fashion Technology
SEE	Semester End Examination	SR	Sound Recording & Engg.	WH	Water Technology & Health Science
		PH	Civil (Public Health & Environment) Engg.	MY	Mechanical Engineering [Machine Tools]
		TD	Tool & Die Making	AR	Architecture
		ID	Interior Decoration		

4.0 INDUCTION PROGRAMME

The Essence and Details of Induction program can also be understood from the “Detailed Guide on Student Induction program’, as available on AICTE Portal, although that is for Diploma students of Engineering & Technology. Suggestive schedule for induction program is given below

(Link: <https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf>).

Induction Program Schedule (Suggestive only)*(Induction program for students to be offered right at the start of the first year)*

SL NO	DAY	TIME	ACTIVITY	VENUE
1	1	09.30-12.30	Registration, Formation of Mentor-mentee groups – Introduction of mentors with-in group.	Class rooms of respective programs
		01.30-04.30	Screening of Institute video clips of various functions held and Photos of various events, Institution Excursion	Seminar hall
2	2	09.30-12.30	Prayer- Physical activities such as yoga; Presentation cum Interactive Session with: Important Institution Functionaries like Principal, HoDs etc.	Play ground and seminar hall
		01.30-04.30	Visit to Central facilities such as Reading room,library,Sport centre, computer centre, hostel, NSS/NCC cell, community development cell functioning in polytechnic	Tour
		01.30-04.30	Lecturer sessions about importance of NSS/NCC/Youth red cross activities and their contribution towards national building and personality and character development	Seminar hall
4	4	09.30-12.30	Personality development talk on Human values	Seminar hall
		01.30-04.30	Interaction with Alumni students of polytechnic of different programs and interaction with few alumina and sharing their experiences	Seminar hall
5	5	09.30-12.30	Introduction to Swatch bharathabhiyan-Importance of abhiyan-Clean drive in around college	Campus
		01.30-04.30	Talent hunt-Music/Antakshri/Instrument play/ Dance/Team Activity	College Auditorium
6	6	09.30-12.30	Talent hunt Activity: Essay/Debate/Best out of Waste/Pick and speak ,other	Seminar hall
		01.30-04.30	Screening of Movie related: personality development, character building, motivational ,Environmental concern, Public health, rural sanitation	College Auditorium
7	7	09.30-12.30	Exchange of views between students and faculty about their Institute/program/carrier opportunities	Seminar hall
		01.30-04.30	Games/Sports Activity	Sports ground
8	8	09.30-12.30	Talk by training and placement cell: Carrier opportunities for diploma students, placement activities in college; placement process	Training and placement cell
		01.30-04.30	Talents hunt Activity: (Street Play/Mime/Acting/Stand Up Comedy /Dance etc.)	Seminar hall
9	9	09.30-12.30	Personality development talks by eminent speakers on - Leadership styles/How to handle failures/stress management	Seminar hall
		01.30-04.30	Importance of student union, student union activities, Student insurance, How to make student insurance by Student welfare officer of college	Seminar hall
10	10	09.30-12.30	Awareness on; Student scholarship- introduction to SSP portal – e-pass portal-Authenticated documents, how to apply in portal: Talk by Taluk/District social welfare officer	Seminar hall

		01.30-04.30	Local visits to surrounding places/Industry	Tour
11	11	09.30-12.30	Talk on Respective Program scheme of studies and detail of courses, Diploma examination pattern, Passing and eligibility criteria, attendance requirements by respective program coordinator	Department Class rooms
		01.30-04.30	Visit to respective programs lab/work shops of institution	Tour
12	12	09.30-12.30	Awareness camp on human health ,Community health, Personal hygiene-By Local Taluk medical officer/Community medical officer	Seminar hall
		01.30-04.30	Collection of student feedback on induction program- Make a report Valedictory of two weeks Induction program by collecting student feed back	Seminar hall

Induction Program (mandatory)	Two- week Duration
Induction program for students to be offered right at the start of the first year.	<ul style="list-style-type: none"> • Physical activity • Creative arts • Universal human values • Literacy • Proficiency modules • Lectures by Eminent People • Visits to Local Areas • Familiarization to Dept./Branch & Innovations

5.0 MANDATORY VISITS/WORKSHOP/EXPERT LECTURES:

1. It is mandatory to arrange one industrial visit every semester for the students of each branch.
2. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/ industry/ entrepreneurial orientation.
3. It is mandatory to organize at least one expert lecture per semester for each branch by inviting resource persons from domain specific industry.

6.0 EVALUATION SCHEME:

A. For Theory Courses:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded

B. For Practical Courses:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for Semester End Exam (SEE) is 40%. The student has to obtain minimum of 40% marks individually both CIE and SEE to pass. The practical Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration exams). Based on this grading will be awarded.

C. For Summer Internship / Projects / Seminar etc.

1. Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note:

- A. The Continuous Internal Evaluation (CIE) is based on the student's performance in Internal Assessment tests, student activity, mini project, quizzes, assignments, seminars, viva-voce in practical, lab record etc as specified in respective course curriculum.
- B. **Major Project/Mini Project:** Students can do their major project in Industry or R&D Labor in house. Mini Project is a laboratory oriented course which will provide a platform to students to enhance their practical knowledge and skills by development of small systems/application.
- C. **Personality and character development:** It is mandatory for the students from 1st semester to enroll in any one of the personality and character development programmes (NCC/NSS/YRC/Yoga/Technical Club) and undergo training for their Personality and character development.
 - National Cadet Corps (NCC).
 - National Service Scheme (NSS) will have social service activities in and around the Institution.
 - Youth Red Cross (YRC) will have activities in and around the institution.
 - Yoga
 - Technical Clubs.
- D. **Internship:** A minimum of 10 credits (400 Hrs) of Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training may be counted toward three-year diploma programme.
- E. **Mapping of Marks to Grades:** Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	Level	Assigned Grade	Grade Point
91-100	Outstanding	A+	10
81-90	Excellent	A	09
71-80	Very Good	B+	08
61-70	Good	B	07
51-60	Above Average	C+	06
45-50	Average	C	05
40-44	Satisfactory	D	04
<40	Fail	F	00
Fail due to shortage of attendance and therefore, to repeat the course/semester.		F*	00
Fail in Continuous internal Evaluation (CIE).		F**	00

Note: Those Candidates who have not obtained requisite minimum pass marks in CIE are not eligible to take up SEE in that course until they get requisite minimum pass marks in the CIE. They may re-register for the CIE in the subsequent regular semesters by paying prescribed examination fee.

SGPA and CGPA Calculations	
Semester Grade Point Average (SGPA)=	$\frac{\sum[(\text{Course Credits earned}) \times (\text{Grade Points})] \text{ for all the courses in that semester}}{\sum[\text{Total Course credits applied}] \text{ for all the courses in that semester}}$
Cumulative Grade Point Average (CGPA)=	$\frac{\sum[(\text{Course Credits earned}) \times (\text{Grade Points})] \text{ for all courses, excluding those with F*/F** grades until that semester}}{\sum[\text{Total Course Credits earned}] \text{ for all Courses excluding those with F*/F** grades until that semester}}$
Note: The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the semester Diploma marks /grade card.	

A. SGPA and CGPA Calculations: An illustrative example for one academic year							
Semester	Course Code	Credits Applied (CA)	Result Grade	Grade Points (GP)	Credits Earned (CE)	Credit points (CP=CE x GP)	SGPA, CGPA
I	Course 1	4	B	7	4	4x7=28	SGPA=CP/CA =110/22 = 5.00
I	Course 2	4	F	0	0	0x0=00	
I	Course 3	4	Absent (F)	0	0	0x0=00	
I	Course 4	4	A	9	4	4x9=36	
I	Course 5	2	A+	10	2	2x10=20	
I	Course 6	2	D	4	2	2x4=08	
I	Course 7	2	A	9	2	2x9=18	
	Total	22			14	110	SGPA = 5.00
Note: In 1 st semester grade/marks card only SGPA is reported. From 2 nd semester onwards both SGPA & CGPA will be reported in the grade/marks card.							
Semester	Course Code	Credits Applied (CA)	Result Grade	Grade Points (GP)	Credits Earned (CE)	Credit points (CP=CE x GP)	SGPA, CGPA
II	Course 1	4	B	7	4	4x7=28	SGPA=CP/CA =100/19 = 5.26
II	Course 2	4	A	9	4	4x9=36	
II	Course 3	3	D	4	3	3x4=12	
II	Course 4	3	Absent (F)	0	0	0x0=00	
II	Course 5	2	A+	10	2	2x10=20	CGPA = CP/CE =(110+136)/(14+22) = 246/36 =6.83
II	Course 6	1	D	4	1	1x4=04	
II	Course 7	2	F	0	0	0x0=00	
		19			14	100	
I Semester Back log courses							
I	Course 2	4	C	5	4	4x5=20	
I	Course 3	4	D	4	4	4x4=16	
	Total	27			22	136	
<ul style="list-style-type: none"> Total credits of the semester excluding the credits of the courses under F/F*/F** grade are considered for the calculation of CGPA of the two consecutive semesters under consideration. 							

B. CGPA Calculation of the entire programme: An Illustrative Example.							
Semester	I	II	III	IV	V	VI	Total
Credits of the Semester	22	19	24	24	24	24	137
ΣCP	110	136	184	155	191	188	964

$$CGPA = \frac{[110+136+184+155+191+188]}{22+19+22+24+24+24} = \frac{964}{137} = 7.04$$

P=Percentage Conversion= (CGPA-0.75) X 10

Class Declaration:

After the conversion of final CGPA into percentage of marks (P), a graduating student is declared to have passed in:

- (i) First Class with Distinction (FCD) if $P \geq 70\%$
- (ii) First Class (FC) if $P \geq 60\%$ but $<70\%$ and
- (iii) Second Class (SC) if $P < 60\%$.

**SCHEME OF STUDIES
DIPLOMA IN ELECTRICAL &
ELECTRONICS ENGINEERING
(C-20)**

CURRICULUM STRUCTURE

I Semester Scheme of Studies - Diploma in Electrical & Electronics Engineering [C-20]

S. N	Course Category / Teaching Department	Course Code	Course Title	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA	
				L	T	P			Max	Min	Max	Min						
THEORY COURSES																		
1	BS/SC	20SC11T	Engineering. Mathematics	4	0	0	4	4	50	20	50	20	100	40			Only SGPA for 1st Semester	
2	ES/EE	20EE11T	Basics of Electrical Power System	4	0	0	4	4	50	20	50	20	100	40				
PRACTICAL COURSES																		
3	HS/EE/EG	20EE12P	Communication Skills	2	0	4	6	4	60	24	40	16	100	40				
4	ES/EE	20EE01P	Fundamentals of Electrical & Electronics Engineering.	2	0	4	6	4	60	24	40	16	100	40				
AUDIT COURSES																		
5	AU/CE/SC	20CE11T	Environmental Sustainability	2	0	0	2	2	50	20	-	-	50	20				
6	AU Physical Activity		Sports/NCC/NSS/Youth Red Cross/Yoga/ Technical club.	Student shall enrol in any one of these activities in 1 st semester and shall participate actively. The student shall obtain 'Participation Certificate' in the activity to get eligible for the award of Diploma.														
Total				14	0	8	22	18	270	108	180	72	450	180				

T:- Theory P:- Practical D:- Drawing E:- Elective BS- Basic Science:: ES-Engineering Science:: HS-Humanities & Social Science:: AU-Audit Course

Note:

- Assigned Grade, Grade Point, SGPA and CGPA to be recorded in the Grade/Marks card.
- AU- Physical Activity- Student participation in the selected physical activity shall be monitored and the participation record shall be maintained by the respective Programme Coordinator (Head of Section).
- Theory course Semester End Examination (SEE) is conducted for 100 marks (3 Hours duration)
- Practical course CIE and SEE is conducted for 100 marks (3 Hours duration)

II Semester Scheme of Studies - Diploma in Electrical & Electronics Engineering [C-20]

Sl. No	Course Category / Teaching Department	Course Code	Course Title	Hours per week			Total contact hrs/week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing	Assigned Grade	Grade Point	SGPA and
				L	T	P			Max	Min	Max	Min					
THEORY COURSES																	
1	ES/EE /EG	20EE21T	Project Management Skills	2	0	4	6	4	50	20	50	20	100	40			
PRACTICAL COURSES																	
2	BS/SC	20SC21P	Statistics and Analytics	2	0	4	6	4	60	24	40	16	100	40			
3	ES/ME	20ME01P	Computer Aided Engineering Graphics	2	0	4	6	4	60	24	40	16	100	40			
4	ES/CS	20CS01P	IT Skills	2	0	4	6	4	60	24	40	16	100	40			
5	ES/EE	20EE22P	Residential Electrical Wiring Practice	2	0	4	6	4	60	24	40	16	100	40			
AUDIT COURSES																	
6	AU/KA	20KA21T	Kannada-I	2	0	0	2	2	50	20	-	-	50	20			
Total				12	0	20	32	22	340	136	210	84	550	220			

 SGPA & CGPA of 2nd Semester

T:- Theory P:- Practical D:- Drawing E:- Elective BS- Basic Science:: ES-Engineering Science:: HS-Humanities & Social Science:: AU-Audit Course

Note:

1. Assigned Grade, Grade Point, SGPA and CGPA to be recorded in the Grade/Marks card.
2. Theory course Semester End Examination (SEE) is conducted for 100 marks (3 Hours duration)
3. Practical course CIE and SEE is conducted for 100 marks (3 Hours duration)

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20SC11T	Semester	I
Course Title	ENGINEERING MATHEMATICS	Course Group	Core
No. of Credits	4	Type of Course	Lecture
Course Category	Theory	Total Contact Hours	4Hrs Per Week
			52Hrs Per Semester
Prerequisites	10 th Level Mathematics	Teaching Scheme	(L:T:P) = 4:0:0
CIE Marks	50	SEE Marks	50

RATIONALE

Engineering Mathematics specification provides students with access to important mathematical ideas to develop the mathematical knowledge and skills that they will draw on in their personal and work lives. The course enable students to develop mathematical conceptualization, inquiry, reasoning, and communication skills and the ability to use mathematics to formulate and solve problems in everyday life, as well as in mathematical contexts. At this level, the mathematics curriculum further integrates the three content areas taught in the higher grades into three main learning areas: Algebra; Measurement of angles and Trigonometry and Calculus.

1. COURSE SKILL SET

Student will be able to:

1. Solve system of linear equations arise in different engineering fields.
2. Incorporate the knowledge of calculus to support their concurrent and subsequent engineering studies.
3. Have the idea of vector calculus, its physical interpretation and applications in real life examples.

2. COURSE OUT COMES

At the end of the course, student will be able to

C01	Apply the concepts of matrices and determinants to solve real life problems which are expressed in the form of the system of linear equations.
C02	Calculate trigonometric ratios of any magnitude in solving problems of engineering concepts.
C03	Represent vectors in 2 and 3 dimensions. Find dot and cross product of vectors and apply it engineering fields.
C04	Find the equation of straight line in different forms. Determine the parallelism and perpendicularity of lines.
C05	Differentiate various continuous functions and apply the concept in real life situations.

CO6	Integrate various continuous functions and apply the concept in evaluating the area and volume through definite integrals.
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3. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS

UNIT NO	UNIT TITLE	TEACHING HOURS	DISTRIBUTION(THEORY)			
			R LEVEL	U LEVEL	A LEVEL	TOTAL
1	Matrices and Determinants	6	8	12	20	40
2	Trigonometry	10	8	12	20	40
3	Vector Calculus	8	4	6	10	20
4	Straight lines	8	4	6	10	20
5	Differential Calculus. and applications	10	8	20	12	40
6	Integral Calculus. and applications	10	8	20	12	40
	Total	52	46	62	92	200

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

4. DETAILS OF COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics/Sub topics	Hours L-T-P
UNIT-1 MATRICES AND DETERMINANTS	1. Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, eigen values and eigen vectors,	1.1 Matrix and types, Algebra of Matrices(addition, subtraction, and multiplication) 1.2 Simple problems on algebra of matrices 1.3 Evaluation of 2x2 and 3x3 determinants 1.4 Cramer's rule for solving system of linear equations involving 2 and three variables. 1.5 Adjoint and Inverse of the non singular matrices. 1.6 Characteristic equation and Eigen values of a 2x2 matrix.	06-0-0

UNIT-2 TRIGONOMETRY	1. Use basic trigonometric skills in finding the trigonometric ratios of allied and compound angles. 2. Able to find all the measurable dimensions of a triangle.	2.1 Concept of angles and their measurement. Radian measure and related conversions. 2.2 Trigonometric ratios of allied angles. 2.3 Trigonometric ratios of compound angles(without proof) 2.4 Transformation formulae(product to sum and sum to product) 2.5 Solution to triangles(sine rule and cosine rule)	10-0-0
UNIT-3 VECTOR CALCULUS	1. Represent a vector in 2D and 3D form 2. Determine the projection of two vectors and work done by the force. 3. Use the basic properties of vectors to determine Moment of the force 4. Able to find the area of the triangle and parallelogram formed by vectors.	3.1 Algebra of vectors(add, subtract,multiply ,position vectors and componentsof 2D and 3D vectors) 3.2 Dot product of vectors and Cosine of angle between vectors. 3.3 Determine the projection of vectors and work done by the force. 3.4 Cross product of vectors Sine of angle between the vectors. 3.5 Area of the triangle and parallelogram and Moment of the force	08-0-0
UNIT-4 STRAIGHT LINES	1. Able to find the equation of straight lines in different forms. 2. Determine whether lines are parallel or perpendicular. 3. Determine whether the lines intersect or not.	4.1 Slope of a line 4.2 Slope-point formula 4.3 Two-point form 4.4 Slope intercept form 4.5 General form of a straight line 4.6 Conditions for lines to be parallel or perpendicular. 4.7 Equation of a line parallel or perpendicular to the given line. 4.8 Conditions for lines to intersect.	08-0-0
UNIT-5 DIFFERENTIAL CALCULUS AND APPLICATIONS	1. Able to differentiate algebraic, exponential, trigonometric, logarithmic and composite functions. 2. Able to find higher order derivatives. 3. Understand and work with derivatives as rates of change in mathematical models. 4. Find local maxima and minima of a function.	5.1 Derivatives of continuous functions in an interval. 5.2 Sum rule, difference rule, product rule and quotient rule. 5.3 Chain rule 5.4 Successive differentiation(up to second order) 5.5 Rate and measure. Find the velocity and acceleration of a displacement vector at any point of time. 5.6 Local Maxima and Minima of a function.	10-0-0

UNIT-6 INTEGRAL CALCULUS AND APPLICATIONS	<ol style="list-style-type: none"> 1. Understand the basic rules of integration and Evaluate integrals with basic integrands. 2. Identify the methods to evaluate integrands. 3. Apply the skills to evaluate integrals representing areas and volumes. 	<ol style="list-style-type: none"> 6.1 List of standard integrals and Basic rules of integration. 6.2 Evaluation of integrals of simple function and their combination. 6.3 Substitution method 6.4 Integration by parts. 6.5 Concepts of definite integrals. 6.6 Find the area enclosed by the curve(simple rational integrand) 6.7 Find the volume generated by the Curve rotated at an axis. 	10-0-0
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5.MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	CL R/U/A	Theory in Hrs	TOTAL
CO1	Students are able to apply the concepts of matrices and determinants to solve real life problems which are expressed in the form of the system of linear equations	1, 2, 7	1	R/U/A	6	6
CO2	Students are able to acquire the knowledge of trigonometry to appreciate the importance of the geometric study as well as for the calculation and the mathematical analysis.	1, 7	2	R/U/A	10	10
CO3	Students are able to apply the basic knowledge of vector dot and cross product in solving the problems of work done by the force and moment of a force.	1, 7	3	R/U/A	8	8
CO4	Students are able to find the equation of straight lines in different forms and describe the parallelism and perpendicularity of lines.	1, 7	4	R/U/A	8	8
CO5	Students are able to differentiate functions and apply the skills of differentiation in Engineering field.	1, 7	5	R/U/A	10	10
CO6	Students are able evaluate integrals and apply the skills of integration in engineering field	1, 7	6	R/U/A	10	10
					52	100

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
ENGINEERING MATHEMATICS	CO1	3	1	0	0	0	0	1
	CO2	3	0	0	0	0	0	1
	CO3	3	0	0	0	0	0	1
	CO4	3	0	0	0	0	0	1
	CO5	3	0	0	0	0	0	1
	CO6	3	0	0	0	0	0	1

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

7. INSTRUCTIONAL STRATEGY

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes

1. Explicit instruction will be provided in intervention classes or by using different differentiation strategies in the main classroom.
2. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching method and media that are employed to develop the outcomes.
3. Observing the way their more proficient peers use prior knowledge to solve current challenges and persevere in problem solving will help struggling students to improve their approach to engaging with rich contextual problems.
4. Ten minutes a day in homeroom, at the end of class, or as a station in a series of math activities will help students build speed and confidence.
5. Topics will be introduced in a multiple representation.
6. The teacher is able to show different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. In a perfect world, teacher would always be able to demonstrate how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. When a concept cannot be applied in that manner, we can still share how it might be applied within mathematics.

8. SUGGESTED LEARNING RESOURCES:

SlNo.	Author	Title of Books	Publication/Year
1	B.S. Grewal, ,	Higher Engineering Mathematics	Khanna Publishers, New Delhi, 40th Edition,2007
2	G. B. Thomas, R. L. Finney	Calculus and Analytic Geometry	Addison Wesley, 9th Edition, 1995
3	S.S. Sabharwal, Sunita Jain, Eagle Parkashan	Applied Mathematics, Vol. I & II	Jalandhar.
4	Comprehensive Mathematics	Comprehensive Mathematics Vol. I & II	Laxmi Publications, Delhi
5	ReenaGarg&Chandrika Prasad	Advanced Engineering Mathematics	Khanna Publishing House, New Delhi

9. COURSE ASSESSMENT AND EVALUATION CHART

Sl.No	Assessment	Duration	Max marks	Conversion
1	CIE Assessment 1 (Written Test -1) At the end of 3 rd week	80 minutes	30	Average of three written tests 30
2	CIE Assessment 2 (Written Test -2) At the end of 7 th week	80 minutes	30	
3	CIE Assessment 3 (Written Test -3) At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) At the end of 5 th week	60 minutes	20	Average of three 20

5	CIE Assessment 5 (Open book Test) At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment) At the end of 11 th week	60 minutes	20	
Total Continuous Internal Evaluation (CIE) Assessment				50
8	Semester End Examination(SEE) Assessment (Written Test)	3 Hours	100	50
Total Marks				100

Note:

1. SEE (Semester End Examination) is conducted for 100 Marks theory course for a time duration of 3 Hours.
2. Three CIE (written test) , each of 30 marks for a time duration of 30 marks shall be conducted. Also three CIE (MCQ or Quiz/Open book test/student activity or assignment) each of 20 marks for the time duration of 60 minutes shall be conducted. Any fraction at any stage during evaluation will be rounded off to the next higher digit
3. Assessment of assignment and student activity is evaluated through appropriate rubrics by the respective course coordinator. The secured mark in each case is rounded off to the next higher digit.

10 DETAILED COURSE CONTENT

UNIT NO AND NAME	DETAILED COURSE CONTENT	CO	PO	CONTACT HRS	TOTAL
1 MATRICES AND DETERMINANTS	Definition of matrix and types of matrices Algebra of matrices: Addition and subtraction. Problems.	1	1	1	6
	Multiplication of matrices. Problems.	1	1	1	
	Definition of a determinant, Expansion of second and third order determinants.	1	1	1	
	Application of determinants to solve linear equations(Cramer's Rule) (upto the order 3x3). (Suggested to solve problems on mesh current ananalysis)	1	1	1	
	Adjoint and Inverse of a non singular matrix. Problems.	1	1	1	

	Characteristic equation and eigen values of a 2x2 matrix.	1	1	1	
2 TRIGONOMETRY	Concept of angles, measurement of angles in degrees, gradians and radians. Problems on conversion of angles from degree measure to radian measure and vice versa.	2	1	1	10
	Trigonometric ratios of Allied angles (Without proof).	2	1	1	
	Problems on allied angles. (Simple problems)	2	1	1	
	Trigonometric ratios of Compound angles (without proof): Evaluation of Tr ratios of 15 and 75 . Simple problems.	2	1	1	
	Problems on compound angle formulae.	2	1	1	
	Problems on compound angle formulae.(continued)	2	1	1	
	Transformation formulae(without proof) as sum to product. (Simple problems)	2	1	1	
	Transformation formulae(without proof) as product to sum. (Simple problems)	2	1	1	
	Solution to triangles-SINE RULE	2	1	1	
	Solution to triangles-COSINE RULE	2	1	1	

3 VECTOR CALCULUS	Definition and notation of a vector and types of vectors. Addition, subtraction and multiplication of vectors.	3	1	1	8
	Components of vectors. Resolution of vectors and Position vectors in 2D and 3D. (Simple problems)	3	1	1	
	Definition of dot product of vectors. Orthogonal vectors.	3	1, 2	1	
	Cosine of angle between the vectors. Projection of vectors.	3	1	1	
	Problems on Work done by vectors.	3	1	1	
	Definition of Cross product of vectors. Sine of angle between the vectors.	3	1	1	
	Area of the triangle and parallelogram formed by adjacent vectors.	3	1, 2	1	
	Moment of the force.	3	1	1	
4 STRAIGHT LINES	Slope and intercept of a straight line.	4	1	1	8
	Slope - point form of a straight line. Problems	4	1	1	
	Slope-Y-intercept form of a straight line. Problems	4	1	1	
	Intercept form of a straight line. Problems	4	1	1	
	General form of a straight line. Determination of slope, X-intercept and Y-intercept from general form.	4	1	1	
	Equation of a line parallel to the given line.	4	1	1	
	Equation of a line perpendicular to the given line.	4	1	1	
	Conditions for lines to intersect.	4	1	1	

5	DIFFERENTIAL CALCULUS AND APPLICATIONS	Listing the derivatives of standard functions.(Algebraic, trigonometric, exponential and logarithmic).	5	1	1	10
		Addition and subtraction rule of differentiation.	5	1	1	
		Product rule and quotient rule of differentiation.	5	1	1	
		Product rule and quotient rule of differentiation.(Continued).	5	1	1	
		Composite functions and their derivatives.(CHAIN RULE).	5	1	1	
		Composite functions and their derivatives.(CHAIN RULE). (Continued)	5	1	1	
		Successive differentiation upto second order.	5	1	1	
		Rate and measure: velocity and accelation at a point of time.	5	1,2	1	
		Local Maxima and Minima of a function.	5	1	1	
		Local Maxima and Minima of a function.(Continued)	5	1	1	
6	INTEGRAL CALCULUS AND APPLICATIONS	Listing the Integrals of standard functions.(Algebraic, trigonometric, exponential and logarithmic).	6	1	1	10
		Evaluation of integrals with simple integrands and their combinations.	6	1	1	
		Evaluation of integrals with simple integrands and their combinations. (Continued)	6	1	1	
		Substitution method.	6	1	1	
		Integration by parts.	6	1	1	
		Integration by parts. (continued)	6	1	1	
		Definition of definite integrals and their evaluation.	6	1	1	
		Evaluation of Definite integrals. (continued)	6	1	1	
		Area enclosed by the curves by integral method.	6	1,2	1	
		Volume generated by the curve rotated about an axis by integral method.	6	1,2	1	

**Model Question Paper
Semester End Examination**

Programme:	Semester: I
Course :	Max Marks: 100
Course Code:	Duration: 3 Hrs

Instruction to the Candidate:

Answer one full question from each section. One full question carries 20 marks.

Qn.No	Question	CL	CO	Marks
Section-1				
1.a)				
b)				
2.a)				
b)				
Section-2				
3.a)				
b)				
4.a)				
b)				
Section-3				
5.a)				
b)				
6.a)				
b)				
Section-4				
7.a)				
b)				
8.a)				
b)				
Section-5				
9.a)				
b)				
10.a)				
b)				

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20EE11T	Semester	I
Course Title	BASICS OF ELECTRICAL POWER SYSTEM	Course Group	Core
No. of Credits	4	Type of Course	Lecturing, Student Activity and Assignment
Course Category	ES	Total Contact Hours	4Hrs Per Week
			52Hrs Per Semester
Prerequisites	Basic Science	Teaching Scheme	(L:T:P)= 4:0:0
CIE Marks	50	SEE Marks	50

1. RATIONAL

A power system comprises of the various subsystems that include generation, transmission, and distribution and Load. Basic knowledge of Electrical Power System **is essential for student of diploma in electrical Engineering** to work in Generation, transmission and distribution field. An electrical engineering diploma student must be knowledgeable about various sources of energy, construction and operation of conventional and non-conventional power plants, economics of power generation and techniques of transmission and distribution. The study of basic concepts of electrical power generation will help the student to understand various issues associated with Generation, transmission and Distribution.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

- **Select the site** for Hydroelectric, Thermal, Nuclear, Wind and Solar power plants.
- **Construction and operation** of conventional and non-conventional power plants.

3. COURSE OUT COMES

On successful completion of the course, the students will be able to:

CO1	Describe the Non-renewable energy methods of Generation.
CO2	Describe the Renewable energy methods of Generation.
CO3	Analyze the economic operation of power generation.
CO4	Describe basic elements of the electric transmission and distribution systems

4. COURSE TOPICS:

Unit No	Unit Name	Hours
1	Hydroelectric and Thermal Power plants	08
2	Nuclear power plant, Diesel power plant and Gas turbine power plant.	06
3	Solar photovoltaic system and Wind Power plant	10
4	Biomass Power, Fuel cell and Hybrid PV systems	7
5	Economics of Power Generation	06
6	Basics of Transmission and Distribution	15
	Total	52

5. DETAILS OF COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Session No.	Contents	Class Hour L:T:P
Unit-I	Hydroelectric and Thermal power plants	08 hrs
1	Power sector scenario including generation, transmission, and distribution scenario of India	1:0:0
2	Introduction -Importance of electrical power generation. Sources of energy available in nature. Conventional and non-conventional sources.	1:0:0
3	Hydro power plant -Factors to be considered for selection of site and Classify hydroelectric power plants based on the available head of water, plant capacity, load and construction.	1:0:0
4	General layout of hydro power plant and explain of its components. Meaning of water hammer and its effect.	1:0:0
5	Advantages and Disadvantages of Hydroelectric power plant. Environmental Impact of Hydel power plant	1:0:0
6	Thermal power plant - Factors to be considered for selection of site. General layout of thermal (steam) power plant.	1:0:0
7	Working of thermal power plant. Advantages and disadvantages of Thermal power plant. Environmental Impact of Thermal power plants	1:0:0
8	Activity based Learning on Hydroelectric and Thermal power plant	1:0:0
Unit-II	Nuclear, Diesel and Gas turbine power plants	06hrs
9	Nuclear power plant -Factors to be considered for selection of site and Schematic diagram of nuclear power plant.	1:0:0
10	Construction and working of Nuclear power plant.	1:0:0

Session No.	Contents	Class Hour L:T:P
11	Nuclear power plant impacts such as Health physics, nuclear wastes and nuclear waste disposal. Comparison between thermal power plant with nuclear power plant.	1:0:0
12	Diesel power plant -Schematic diagram of a Diesel generator unit and main components. Advantages and Disadvantages of Diesel power plant	1:0:0
13	Gas turbine power plant - Schematic diagram of a Gas turbine power plant. Advantages and Disadvantages of Gas turbine plant	1:0:0
14	Activity based Learning onNuclear, Diesel and Gas turbine power plants	1:0:0
Unit-III	Solar photovoltaic system and Wind Power plant	10 hrs
15	Photovoltaic effect, solar power, Construction of solar cell, solar photovoltaic module with block diagrams.	1:0:0
16	Construction of photovoltaic panel and PV array with block diagrams. Materials used in solar cells and Solar cells Applications.	1:0:0
17	Classification of solar photovoltaic systems.	1:0:0
18	Stand-alone and grid interactive solar PV system with block diagram	1:0:0
19	Advantages and dis-advantages of PV systems and environmental impacts of solar PV system on environment.	1:0:0
20	Importance of Wind Energy. Explain the origin of Global and local winds.	1:0:0
21	Factors affecting distribution of wind energy on surface of the earth. Factors to be considered for site selection.	1:0:0
22	Nature of winds with neat sketches.	1:0:0
23	Classification of wind turbine generator, Comparison between horizontal axis and vertical axis wind turbine generator Environmental Impact of wind plants.	1:0:0
24	Activity based Learning onSolar PV system and Wind Power plant	1:0:0
Unit-IV	Biomass Power, Fuel cell and Hybrid PV systems	07hrs
25	Urban waste to energy conversion - Block diagrammunicipal solid waste (MSW) to energy incineration plant.	1:0:0
26	Biomass power plant - Importance of biomass energy and its scope. Factors to be considered for site selection. Line diagram of biomass power plant.	1:0:0
27	Biogas plants, Types of biogas plants.	1:0:0
28	Fuel cells - fuel cell. Classification of fuel cells.	1:0:0

Session No.	Contents	Class Hour L:T:P
29	Hybrid PV systems-Types of hybrid PV systems.	1:0:0
30	Block diagram PV-Wind hybrid system and, PV-fuel cell hybrid system.	1:0:0
31	Activity based Learning on Biomass Power, Fuel cell and Hybrid PV systems	1:0:0
Unit-V	Economics of Power Generation	6 Hrs
32	Related terms: connected load, firm power, cold reserve, hot reserve, spinning reserve.	1:0:0
33	Base load and peak load plants; Load curve, load duration curve, integrated duration curve	1:0:0
34	Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor.	1:0:0
35	Simple problems on Cost of generation	1:0:0
36	Choice of size and number of generator units, combined operation of power station.	1:0:0
37	Activity based Learning on Economics of Power Generation	1:0:0
Unit-VI	Basics of Transmission and Distribution	15 Hrs
38	Transmission: AC transmission and distribution system with typical Single line diagrams with components of the electric supply transmission and distribution systems.	1:0:0
39	Classification of transmission lines: Primary and secondary transmission; standard voltage level used in India	1:0:0
40	Classification of transmission lines: based on type of voltage, voltage level, length and others, Characteristics of high voltage for power transmission.	1:0:0
41	HVDC transmission lines-block diagram, list and explain the functions of main components of HVDC transmission system	1:0:0
42	AC Distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system.	1:0:0
43	Connection schemes of distribution system- radial, ring main and interconnected systems. Distinguish between Feeder, distributor and service main.	1:0:0
44	Substation and receiving station and their functions, Classification of substations.	1:0:0
45	Single Line diagram (layout) of 66/11KV Substation, Symbols and functions of their components.	1:0:0
46	Single Line diagram (layout) of 11KV/400V Sub-Station Symbols and functions of their components.	1:0:0
47	Causes and Impact and reasons of Grid system fault: State grid, national grid, brownout and black out, Sample blackouts at national and international level	1:0:0
48	Explain Black start Restoration	1:0:0

Session No.	Contents	Class Hour L:T:P
49	Explain Demand side Management	1:0:0
50	Functions of Load Dispatch Centre	1:0:0
51	Functions of Power Generation and Distribution Companies Different electric distribution companies and their functions (BESCOM, MSCOM, HESCOM etc.)	1:0:0
52	Activity based Learning on Basics of Transmission and Distribution	1:0:0
TOTAL		52 Hrs

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

UnitNo	Unit Title	CO	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total
I.	Hydroelectric and Thermal Power plants.	1	08				
II.	Nuclear power plant, Diesel power plant and Gas turbine power plant.		06				
III.	Solar photovoltaic system and Wind Power plant.	2	10				
IV.	Biomass Power, Fuel cell and Hybrid PV systems.		7				
V	Economics of Power Generation and Interconnected Power System.	3	06				
VI	Basics of Transmission and Distribution.	4	15				
Total			52				200

7. INSTRUCTIONAL STRATEGY

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Arrange visits to nearby power plants, receiving station and substations.
- Show Video/animation films /games to explain functioning of various power plants.
- Encourage **collaborative** (Group Learning) Learning in the class
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes **critical thinking**
- Adopt Game based Learning (GBL)**, which helps student to improve **critical thinking, planning and Problem-Solving skills**
- Adopt Problem Based Learning (PBL)**, which fosters students **Analytical skills**, develop **thinking skills** such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

8. SUGGESTED LEARNING RESOURCES**Reference Books:**

Principles of power system by V.K.Mehta and Rohit Mehta S.CHAND
Generation of Electrical Energy, by B.R.Gupta, publisher S.chand& company LTD, New Delhi
Electrical Power Generation, Transmission and Distribution. - S.N.Singh. PHI Publications.
Elements of power station design-M V Deshpande-PHI Publications
Power Plant Engineering - A. K. Raja, New Age International Publisher
Generation Distribution and Utilisation of electric energy by C.L. Wadwa, -New-Age International Publisher
Non-conventional Energy Resources - G.S.Sawhney, PHI publications, second Printing-2014, Delhi-110092.
Non-conventional Energy Resources-B.H.Khan 2 nd Edition Tata McGraw hill PVT, New-Delhi.
Solar photovoltaic Technology and systems, - Chetan Singh Solanki, PHI, Delhi-110092.
Generation of Electrical Energy, by B.R.Gupta, publisher S.chand& company LTD, New Delhi
Transmission, distribution and utilization – vol 3 B.L Thereja and A.K.Theraja.
Transmission and Distribution of Electric Power by J.B Gupta Katsons Publications.

E-resources:

1. https://en.wikipedia.org/wiki/Electricity_generation.
2. <https://www.google.com/phindia.com//solarphotovoltaics>.
3. <https://www.schandgroup.com>.
4. <https://www.tatamcgrawhill.com>
5. <https://www.youtube.com/watch?v=daeyoS-PCUA> (Generation, distribution and transmission of electrical power)
6. <https://www.youtube.com/watch?v=IdPTuwKEfmA> (Thermal power plant)
7. <https://www.youtube.com/watch?v=zcWkEKNvqCA> (Gas turbine power plant)
8. <https://www.youtube.com/watch?v=-hooifWJ1jY> (Hydroelectric power plant)
9. <https://www.youtube.com/watch?v=bQ23kCvokAc> (Nuclear power plant)
10. https://www.youtube.com/watch?v=eAX_fk_c8Mc (Diesel power plant)
11. <https://www.youtube.com/watch?v=ZLgOoMSIS3Y> (Solar)
12. https://www.youtube.com/watch?v=qSWm_nprfqE (wind)
13. <https://www.youtube.com/watch?v=VkTRcTyDSyk> (Tidal)
14. <https://www.youtube.com/watch?v=sZuc4LMtHoY> (Wave)
15. <https://www.youtube.com/watch?v=OL26yYFmDHU> (Ocean thermal)
16. <https://www.youtube.com/watch?v=3UafRz3QeO8> (Biogas)
17. https://www.youtube.com/watch?v=nV17JLn_u0 (Biomass)
18. <https://www.youtube.com/watch?v=bXHwnKMchkk> (Fuel cell)
19. <https://www.youtube.com/watch?v=qjY31x0m3d8> (Transmission lines)
20. <https://www.youtube.com/watch?v=WUHcVXjfsxs> (Transmission and distribution)
21. https://www.youtube.com/watch?v=R_HGnc63QKU (Power blackout)
22. <https://www.pbs.org/wgbh/nova/labs/lab/energy/1/1/> (Alternative energy)

9.MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	Cognitive Level R/U/A	Theory Session In Hrs.
C01	Describe the Non-renewable energy methods of Generation.	PO1	1-2	R/U	14
C02	Describe the Renewable energy methods of Generation.	PO1	3-4	R/U	17
C03	Analyze the economic operation of power generation.	PO1	5	A	06
C04	Describe basic elements of the electric transmission and distribution systems	PO1	6	R/U	15
					52

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
BASICS OF ELECTRICAL POWER SYSTEM	CO1	3	-	-	-			
	CO2	3						
	CO3	3						
	CO4	3						
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

10. ACTIVITY BASED LEARNING:

1. We have to create interest among the students through Activity-Based Learning (ABL)
2. Classroom activities will give simultaneous benefits to both students as well as for teachers (students can overcome the difficulty in learning typical course, teachers can deliver a topic in a variety of approaches effectively).
3. Collaborative learning among students will create a healthy learning environment and also emphasize student's performance, teamwork.
4. Any student tries to identify a solution for a given problem but, through collaborative learning with a group of people will give an **optimized** solution to the same **problem**.

In order to develop **higher order thinking skills**, it is important to conduct lessons using **activity-based teaching**.

Activity Based Learning Suggested Activities in Class
1. Identification of Topic (IOT): <ul style="list-style-type: none"> • The objective of this activity is to identify, recollect the technical words in. • Identification of topic names /part name, parts of an apparatus, a mistake in the content in given image.
2. Word search: place technical words, components names of in the 12 x 12 table in various

directions (left to right, right to left, top to bottom, bottom to top, diagonally from top to bottom and diagonally bottom to top from both sides (left, right)). The objective of this activity is to search technical words in the course.

3. **Mind map:** Students have to draw a variety of mind maps by interfacing power system topics with aspects of societal, environment, etc. By these mind maps students elevated power system concepts in a different approach, so that they can remember the concepts for a long time.
 - <https://creately.com/diagram/example/i08rf3b52/Mind%20Map%20of%20Hydroelectric%20Dam>.
 - <https://durofy.com/mind-map-energy-resources>
 - <https://www.brighthubengineering.com/power-plants/17353-electricity-generation-in-power-plants/>
4. **Mapping/Scratch Cards:** Prepare various quiz questions cards, answers cards, and scratch cards. Separate, question cards on the left side, answer cards on the right side and asked batch-wise to map question cards with answer cards.
<https://www.essentialenergy.com.au/ext/electricity-and-safety-unit/assets/documents/Lesson%204%20-%20Practical%20-%20Generation%20and%20movement%2011.pdf>
5. **Crossword:** create a cross on any of the topics of the course using online resources :
https://wordmint.com/public_puzzles/182138
 Students have to draw various types of power plants that are exploring their creativity
6. **Preparing Posters/ chart:** students have to prepare posters/ charts on various topics of power system and present in the class.

7. Energy games

Energy Island game

<http://siemens.zincmediadev.com/energy/island/index.html>

Game on wind and Solar Power Generation

<https://climatekids.nasa.gov/power-up/>

Game on Solar Power Generation

<https://wonderville.org/asset/solarenergydefenders>

Game on wind , Solar Power, Hydel and Geothermal Generation

<https://wonderville.org/asset/save-the-world>

Game on Generation, Transmission and Distribution

<http://www.hydroquebec.com/games/network/flash.html>

Mange Virtual power Plant and prevent blackout

<https://www.next-kraftwerke.com/virtual-power-plant-vpp-simulation/?lang=en>

Game on Power GRID

<https://gamejolt.com/games/powerthegrid/306616>

Game on Design Renewable future

<https://www.pbs.org/wgbh/nova/labs//lab/energy/research>

Game on Energy City

https://assets.jason.org/resource_assets/8239/3733/popup.html

8. **Case Studies:** Through this activity, students will get to know about problems/issues which are happening/happened in the Power System sector.

11. SUGGESTED LIST OF STUDENT ACTIVITY for CIE

Sl No	Activity
1	<p>Problem Based Learning Activity for CIE</p> <p>Task is to organize the energy technology for a farm. This should provide the farm with energy to carry out various functions, such as keeping the lights on (when it's dark), powering the equipment (such as the milking parlor) and keeping the house warm.</p> <ul style="list-style-type: none"> • student have a budget of 20 tokens to set the system up. Each piece of equipment has a price, so student need to make decisions about what to spend the tokens on. • Once student set the system up, then run it for a (simulated) week. At the end of the week student can then see how well it has worked. <p>http://siemens.zincmediadev.com/energy/island/index.html https://new.siemens.com/uk/en/company/education/students/interactives.html#AdditionalResources https://assets.new.siemens.com/siemens/assets/api/uuid:692addfc-d92c-4397-b8b1-c0a3d9a32601/version:1570547738/energy-farm-ks3-student-worksheets-25sept2019.pdf</p> <p>Assessing success</p> <p>There are three sets of criteria students will be judged against:</p> <ol style="list-style-type: none"> 1. Did student get through the week without the lights going out? 2. What were running costs? 3. Did student manage to minimize the negative impact on the environment? <p>Teacher will brief student</p> <ul style="list-style-type: none"> • on the use of the interactive resource, explaining the decisions student need to make • and showing the feedback, student will get on how well the system has performed • Student can then modify the system to try and improve its performance <p>From student best performance:</p> <p>Did student manage to keep the lights on all week? What did the system cost to run? What was the environmental impact of the system? Now think about how student managed to set up an effective system: What hints would student give to someone trying to set up an effective system and get a good score?</p> <p>What would student say about whether (and, if appropriate, how many) to use of: Solar cells Wind turbines Biogas generators Batteries National Grid link Petrol generators</p> <p>Teacher will then show you the feedback screens from some other people's attempts at setting up a system. Have a look at them and comment on how good a job they've done.</p>
2	Visit to solar PV plant and windmill and bio-gas plants and submit the report

3	Visit to hydroelectric power plant, thermal power plants and D.G. power plant. and submit the report
4	Design calculations for establishing a Solar panel/ system for a lighting purpose using Inverter, battery,
5	Design and establish solar operated application to 1) pump 2) Street lamp 3) fan 4) traffic signal control. 4) Rural electrification 5) Rooftop lighting any ONE
6	1. Visit http://www.nhpcindia.com/ collect the following information a) installed capacity b) Total capacity and Design energy of Different Hydroelectric power electric stations in India 2. Visit NTPC website https://www.ntpc.co.in/ collect information on a) Coal based Power stations b) Gas based Power stations c) Renewable Energy d) Hydro based power stations e) career opportunities for Diploma engineers
7	Visit http://karnatakapower.com/ collect information on a) Hydro-electric power plant in Karnataka b) Thermal electric power plant in Karnataka c) Renewable electric power plant in Karnataka d) Daily Generation in MU E) Consumption in MU
8	Visit https://www.powergridindia.com/ collect information on overview of company

12.COURSE ASSESSMENT AND EVALUATION CHART

Sl.No	Assessment	Duration	Max marks	Conversion
1.	CIE Assessment 1 (Written Test -1) At the end of 3 rd week	80 minutes	30	Average of three written tests 30
2.	CIE Assessment 2 (Written Test -2) At the end of 7 th week	80 minutes	30	
3.	CIE Assessment 3 (Written Test -3) At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) At the end of 5 th week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Open book Test) At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment)- At the end of 11 th week	60 minutes	20	
7.	Total Continuous Internal Evaluation (CIE) Assessment			50
8.	Semester End Examination (SEE) Assessment	3 Hours	100	50
Total Marks				100

13. RUBRICS

RUBRICS FOR ACTIVITY						
Appropriate rubrics as per the activity to be developed by the faculty						
Dimension	Beginning	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	
Total marks						

**Model Question Paper
I A Test (CIE)**

Programme	:		Semester: I		
Course	:		Max Marks : 30		
Course Code	:		Duration : 1 Hr 20 minutes		
Name of the course coordinator:			Test : I/II/III		
Note: Answer one full question from each section. One full question carries 10 marks.					
Qn.No	Question	CL	CO	PO	Marks
Section-1					
1.a)					
b)					
c)					
2.a)					
b)					
c)					
Section-2					
3.a)					
b)					
c)					
4.a)					
b)					
c)					
Section-3					
5.a)					
b)					
c)					
6.a)					
b)					
c)					

Model Question Paper Semester End Examination

Programme:	Semester: I
Course :	Max Marks: 100
Course Code:	Duration: 3 Hrs

Instruction to the Candidate:

Answer one full question from each section. One full question carries 20 marks.

Qn.No	Question	CL	CO	Marks
Section-1				
1.a)				
b)				
2.a)				
b)				
Section-2				
3.a)				
b)				
4.a)				
b)				
Section-3				
5.a)				
b)				
6.a)				
b)				
Section-4				
7.a)				
b)				
8.a)				
b)				
Section-5				
9.a)				
b)				
10.a)				
b)				

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20EE12P	Semester	I
Course Title	COMMUNICATION SKILLS	Course Group	Core
No. of Credits	4	Type of Course	Tutorial + Practice
Course Category	Workplace Skills / Humanities & Social Sciences	Total Contact Hours	6Hrs Per Week
			78Hrs Per Semester
Prerequisites	Nil	Teaching Scheme	(L:T:P)= 0:1:2
CIE Marks	60	SEE Marks	40

Preamble

Today, Communication is a very important skill for the success of every millennial student. Millennials affinity to use digital media for communication, changing career and working landscapes, and greater competition in colleges and workplaces makes enhancing student communication skills beyond language a must. Rote learning a few tips or tricks the night before an interview or performance review won't do the job if students are trying to make an impression in highly collaborative workplaces of the future. Expectations from students aspiring to be part of such future workplaces are that they have not just good verbal and non-verbal communication skills but also a good understanding of how to use modern tools for effective communication.

Scope

To enable students to communicate clearly and effectively, by improving their verbal and non-verbal communication skills, as well as enhancing interpersonal skills and knowledge of appropriate tools for specific communication strategies.

Course Objectives

The objectives of communication skills course are:

- Build better communication skills: oral and written expressions and body language
- Enable critical thinking
- Empower with active listening skills
- Enable team work/collaboration

Instructional Strategy

To achieve course objectives, it is important to provide the blended mode of instruction for each of the concepts. This blended mode of instruction enables and empowers students with:

- **Understanding of Concept (Theory):**
 - Through definitions, discussions, explanation, conclusions.

- Through demonstrations: Show films or other workplace clips that model various conversation skills. This provides greater clarity of the concept by
 - Enabling observation skills
 - Helping in expression of gesture
 - building confidence
- **Application of Concept (Learning by doing):** It is imperative that to become a good communicator, the skills have to be built by applying the concept in the hypothetically created real life situations. Students are encouraged to participate in each of these activities during lab session to help build the effective communication skills.
 - Use of technology tools like audio books, apps like voice thread or paper telephone, etc.
 - To help in workplace conversions.
 - To increase active listening, pronunciation
 - To help in voice modulation
 - Group discussion
 - Reinforce active listening
 - Enable group debate to imbibe healthy communication strategies
 - Sharpen the skills of “Asking clarifying questions”
 - Sharpen Feedback / Response skills
 - Time management skills
 - Group presentations/peer reviews
 - Enable team work
 - Assess concept understanding
 - Sharpen both oral and written communication skills
 - Group activities:
 - foster critical thinking
 - enable reflective learning
 - Tools usage:
 - Understand the difference between a Dictionary and a Thesaurus
 - Understand “When” and “How” to use these tools for communication

Course Outcomes

After completion of this course, the student shall be able to;

- Communicate
 - Identify audience (colleagues, management, customers/vendors) and use the right methodologies for communication using the right terminology, names, grades and other nomenclature pertaining to the trade, tools and specific equipment.
- Write
 - in at least one language correctly
 - basic level notes and observations
 - job cards, work sheets, basic report writing and responding to emails, simple presentations, job applications, resume
- Read
 - Technical manuals, task sheets/job orders, policies and regulations pertinent to the job, including OEM guidelines.
 - all instructions given in memos, manuals, documents or those put up as posters across the premises
 - safety precautions mentioned in equipment manuals and panels to understand the potential risks associated
- Question
 - Ask right questions

- Use different ways of asking questions
 - Clarifying/Open ended (What, Why, When, Who, Where, How)
 - Close ended
- Present
 - With right Posture & Gesture
 - With greater concept/content clarity
 - With high confidence
 - With voice modulation to capture the attention of audience
- Use technology tools
 - Office productivity
 - Word : Report writing
 - PowerPoint : Creating effective presentations
 - Excel : Data handling/Charts

Course Content

The following are the various units to be taught and assessed in order to ensure the student is able to demonstrate the Course Outcomes mentioned in the **Course Outcome** section.

Pre-assessment:

Teachers are required to administer pre-assessment before starting the actual instruction. This helps in gathering information about students' like their attitude, beliefs, interests, and learning abilities.

Pre assessment expectations:

- To assess current language skill (Pronunciation, usage, sentence formation)
- To assess their ability to comprehend and respond to the instruction
- To assess their interest towards accepting ideas and learning
- To assess their current communication skills: asking questions, listening, communicating with confidence

UNIT 1: English – Introduction Learning outcome: Learn English pronunciation, functional grammar concepts & Reading. To gain confidence in spoken English. This section also covers phonemic awareness, grammar rules to set a strong base for application mode of communication.			
Phonemic awareness	Going over 42 sounds	<i>Examining the understanding of sounds</i> <i>Spelling patterns (Consonant and Vowel blending: CVC words)</i> <i>Pronunciation</i> <ul style="list-style-type: none"> ○ List of words given above (Commonly used words) ○ Diction (speech) 	0:2:2
Functional Grammar Concepts	Revision of Grammar concepts	<i>Parts of speech</i> <i>Sentence structure</i> <i>Examples of right sentences</i> <i>Gender, Singular, Plural</i> <i>Usage of voice (active and passive) and tenses</i>	2:0:0 0:1:0 0:1:0 0:2:0
Comprehension activities	Reading conversations (check the unitwise activity table)	<i>Written test for each comprehension</i>	0:0:2
UNIT 2: Communication Lesson outcome: At the end of the session: <ul style="list-style-type: none"> • Students should be able to <ul style="list-style-type: none"> ○ Understand the communication process, influence of voice/tone, logical organization of thought, comprehension, listening skills. ○ Understand the basic building blocks of communication and strategies for working with each of these blocks. ○ Learn about carrying self, etiquettes of communication. ○ Build positive attitude about self and towards handling communication. ○ Learn the process for effective communication, problem solving techniques, to be confident communicator. 			
INTRODUCTI ON:	What is communication? Why communication? How do we communicate? Communication Theory and Process		1: 2:0
		<i>How communication happens?</i> <ul style="list-style-type: none"> • Pictorial representation of 	0:2:2

	<p>Barriers to communication</p>	<p>communication framework</p> <ul style="list-style-type: none"> • Elements of communication: sender, receiver, message • Refer to activity in Unit activity section. <p>Language</p> <ul style="list-style-type: none"> • Lack of linguistic ability • Grammar <p>Context</p> <ul style="list-style-type: none"> • Psychology • Physiology <p>Systematic</p> <ul style="list-style-type: none"> • inefficient or inappropriate information systems • Lack of communication channel • lack of understanding of the roles and responsibilities <p>Attitude</p> <ul style="list-style-type: none"> • Perceptions • Preconceived notions 	<p>0:2:2 (video clip play, content tutorial, role play)</p>
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<p>Building blocks of communication</p>	<p>People Message Context Listening</p>	<p>People:</p> <ul style="list-style-type: none"> • Empathising with sender’s or receiver’s perception • Intent & Impact on the sender/receiver • Think – Feel – Do model <p>Message: Message channels: <ul style="list-style-type: none"> ○ In person, email, memo, report Be aware of Mental Filters <ul style="list-style-type: none"> ○ Level of understanding/knowledge ○ Personal concerns ○ Pre conceived notions Organize message: <ul style="list-style-type: none"> ○ Critical thinking: organize your thoughts? Use following strategy: <ul style="list-style-type: none"> ▪ Who ▪ What ▪ When ▪ Why ▪ How <ul style="list-style-type: none"> ○ Bundle Primary and Secondary information ○ Mindful about non-verbal message ○ Tone of voice Examples of Types of messages: <ul style="list-style-type: none"> ○ Inform ○ Persuade ○ Cyclical Avoiding Miscommunication: <ul style="list-style-type: none"> • Evaluate (Checking for) understanding of the intent of the message with the receiver – by asking clarifying questions? </p> <p>Context: Define context Importance of context Tune into context <ul style="list-style-type: none"> • Timing • Location • Relationship </p>	<p>0:4:4</p>
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		<p>Listening:</p> <p>Importance of listening</p> <p>Barrier to listening:</p> <ul style="list-style-type: none"> • Mental filters • Multitasking • Information overload <p>Strategies for listening:</p> <ul style="list-style-type: none"> • Recall • Acknowledge • Summarize • Listen with eyes for connecting to non-verbal connection • Empathize • Pay attention • Ask clarifying questions <p>Effective Listening Behaviors:</p> <ul style="list-style-type: none"> • Maintaining relaxed body posture • Leaning slightly forward if sitting • Facing person squarely at eye level • Maintaining an open posture • Maintaining appropriate distance • Offering simple acknowledgements • Reflecting meaning (paraphrase) • Reflecting emotions • Using eye contact • Providing non-distracting environment <p>Behaviors that hinder effective listening</p> <ul style="list-style-type: none"> • Acting distracted • Autobiographical (Telling your own story without acknowledging theirs first) • No response • Invalidating response, put downs • Interrupting • Criticizing • Judging • Giving advice/solutions • Changing the subject • Reassuring without acknowledgment 	

UNIT 3: Verbal Communication

Lesson outcome:

At the end of this session, Students should be able to:

- Understand and define the communication framework structure for each of the verbal communication(in person/telephonic/video conference).
- Understand and apply the verbal communication techniques.
- Use technical jargons in communication.
- Use right body language during verbal communication
- Understand and practice the Active Listening techniques
- Confidently articulate or present the content

<p>Different types of verbal communication:</p>	<p><i>In person</i></p> <p><i>Telephonic</i></p> <p><i>Video conference</i></p>	<p>Use ABC's : Accuracy, Brevity, Clarity</p> <ul style="list-style-type: none"> ○ Introduction ○ Main body of the content ○ Summary <ul style="list-style-type: none"> • Use voice/tone effectively • Reinforcement of Listening skills: Active and Empathetic listening skills • Body language <ul style="list-style-type: none"> ○ Eye contact ○ Body posture ○ Gesture ○ Facial expression ○ Space 	<p>0:2:4</p>
<p>Listening Skills</p>	<p><i>Effective Listening behaviors</i></p> <p><i>Behaviours that hinder effective listening</i></p>	<p>Effective Listening Behaviours:</p> <ul style="list-style-type: none"> • Maintaining relaxed body posture • Leaning slightly forward if sitting • Facing person squarely at eye level • Maintaining an open posture • Maintaining appropriate distance • Offering simple acknowledgements • Reflecting meaning (paraphrase) • Reflecting emotions • Using eye contact • Providing non-distracting environment <p>Behaviours that hinder effective listening</p> <ul style="list-style-type: none"> • Acting distracted • Autobiographical (Telling your own story without acknowledging theirs first) • No response 	

<p>Using technical Jargons:</p>	<p><i>Assignment based project encouraging pupil to use the technical terms in the written and verbal communication.</i> This requires understanding of the core concepts (from subject teacher) and integrating the concept with communication concepts to gain the real time application knowledge.</p>	<ul style="list-style-type: none"> • Invalidating response, put downs • Interrupting • Criticizing • Judging • Giving advice/solutions • Changing the subject • Reassuring without acknowledgment 	
<p>UNIT4: Non-Verbal Communication: Lesson outcome: At the end of this unit, students should be able to:</p> <ul style="list-style-type: none"> • Understand the importance of Body language and its impact. • Use the strategies for effective body language. • Understand the relevance of different elements of emails and how to use them. • Develop the confidence in presenting written content in logical and organized manner with a definitive email framework. • Write different email formats confidently: Job application, Request email, apology email, email responses/feedback. • Confidently write Resume/Curriculum-vitae, Reports, Formal letters and portfolio. • Confidently communicate using technical jargons and with increased vocabulary. 			
<p>Body Language</p>	<p><i>Strategies</i></p>	<p>Body language tips:</p> <ul style="list-style-type: none"> • Keep appropriate distance • Take care of your appearance • Maintain eye contact • Smile genuinely <p>Do's and Don'ts: dos:</p> <ul style="list-style-type: none"> • smile 	<p>0:3:4</p>

<p>Art of Professional writing:</p>	<p>Written communication</p> <p>Emails:</p> <ul style="list-style-type: none"> Structured framework for writing formal emails to emphasize on professional communication in English 	<ul style="list-style-type: none"> stand up confident and straight use appropriate hand gestures Make eye contact with audience Hold neat note cards while presenting content <p>Don'ts</p> <ul style="list-style-type: none"> point at anyone rock backwards and forwards pace across front of room read off slides <p>read off notes</p> <p>Different types of emails: Job application, request letter, letter writing and quick notes</p> <p>Structure of email text:</p> <ul style="list-style-type: none"> Introduction – Beginning of the letter and this plays crucial role as it provides first impression to the reader. <ul style="list-style-type: none"> Who: author (name + position and organisation) what: purpose - controlling idea (what author does or feels) Development: Expand on the Controlling Idea/purpose of the email by answering relevant WH questions <ul style="list-style-type: none"> what, when, where, who, whom, which, whose, why, and how Conclusion: Positive words <ul style="list-style-type: none"> Verb: thank, appreciate, hope, wish Phrases: be glad about, look forward to <p>Email writing samples and practice content in the activity section.</p> <p>Additional essential writing skills – Framework will be provided and assignments will be advised:</p>	<p>0:2:4</p>
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		<ul style="list-style-type: none"> • Resume writing /CurriculumVitae • Report Writing • Portfolio writing • Formal letters 	
<p>UNIT5: English - Reading Skills, Grammar & Vocabulary</p> <p>Lesson Outcome:</p> <p>At the end of the session, student should be able to:</p> <ul style="list-style-type: none"> • Read sentences with punctuation. • Understand the techniques of reading complex words. • Understand and apply the reading techniques for efficient reading. • Understand the usage of communication tools like Thesaurus and Dictionary that aids in improving vocabulary and reading. • Understand and apply the functional grammar aspects in day today communication. 			
Reading skills	<p><i>Comprehension activities</i></p> <p><i>Techniques for smart reading</i></p>	<p>Passage comprehension</p> <p>Conversation comprehension</p> <p>Strategies for smart reading:</p> <ul style="list-style-type: none"> • Skimming and scanning through the text, inferring the meaning • Questioning, summarizing 	0:2: 2
Functional Grammar	<p><i>List of Commonly confused words and how to use/avoid them</i></p>	<p>Set of words to accelerate the English language learning and usage.</p> <p>Strategies to use these words effectively</p>	0:1: 2
Vocabulary	<p><i>Sentences:</i></p> <ul style="list-style-type: none"> ○ Declarative sentence ○ Imperative sentence ○ Interrogative sentence ○ Exclamatory sentence 	<p>Techniques of categorizing sentences, understanding how to build with punctuation and effectively use in the verbal and non-verbal communication. This involves more of hands on activities.</p>	0:1: 2

		Using signature	
One-to-Many	Presentation using PowerPoint	Creating, Editing, Saving slides Using Animation Formatting options	0:1:2
	Webinar / Web Presentation (zoom, Google meet, Skype)	Hosting online meeting using online meeting tools Inviting people Sharing screen	0:1:1
Other	Reports using MS Word	Open, close, Edit and Save usage with documents Layout and strategies for creating report Sample report creation demo with follow on assignment Core subject project report submission assignment	0:1: 2
	Data & Graphs using MS Excel	Open, close, save and edit the excel document Creating data Using basic maths operation in Excel for working with data Creating simple graphs Assignment: For example, creating statistics of subject wise activities completed for 6 months in the credit course	0:1: 2
			4:34:40

Course Class Activity List (Unit-wise)

The following are the various activities that faculty could conduct for each unit are presented below;

Unit No.	Unit Title	Unit Activities
UNIT 1: Activities:	English - Introduction	1. 42 sounds revision: <ol style="list-style-type: none"> 1. s, a, t, i, p, n 2. c k, e, h, r, m, d 3. g, o, u, l, f, b 4. ai, j, oa, ie, ee, or 5. z, w, ng, v, oo, oo 6. y, x, ch, sh, th, th 7. qu, ou, oi, ue, er, ar <ul style="list-style-type: none"> • This helps in reducing the native language impact • Helps in understanding Short and Long vowel words

		<ul style="list-style-type: none"> • Helps in spelling • Helps in pronunciation <p>2. Reading commonly used words loud from the list (list will be provided in the workbook):</p> <ul style="list-style-type: none"> • This helps in getting familiarity with the word pronunciation and helps in reading. <p>3. Blending words activity:</p> <ul style="list-style-type: none"> • Write simple three letter words (CVC/CVCC/CVCV) pattern words: Can, Cap, Snap, cape (list will be provided in the workbook) • Show how to blend with the sound. • Starting with 3 letter words and continuing to 6 to 8 letter words. <i>Note: Remember before going through big words, it is always important to assess and ensure the student is aware of all the 42 sounds and are comfortable making small words.</i> <p>Parts of Speech:</p> <p>building sentence using parts of speech: Demonstration by teacher: (Will be explained in the book as an example)</p> <p>Jumbled parts of speech: Student should pick the right order to build meaningful sentence:</p> <p>(More samples will be provided in the workbook)</p> <ul style="list-style-type: none"> • College go to you every day. • Makes spider web the a <p>Gender, Singular and Plurals:</p> <ul style="list-style-type: none"> • Match the following activity for singular and plural • Fill in the blanks activity for genders <p>Reading & Comprehension: Conversation</p> <ul style="list-style-type: none"> • Conversation at the bank (provided in the workbook along with few more conversation samples) • Questions based on this conversation will be provided in the workbook
<p>Unit 2</p>	<p>Communication</p>	<p>Oral:</p> <ul style="list-style-type: none"> • Introduce yourself? <p>Visual:</p> <ul style="list-style-type: none"> • Video clip on communication etiquette • Pictures (in addendum section): do's and don'ts of communication

		<p>Group of students, one participant whispers in another participant's ear, and this message has to be passed on in a circle until it reaches back the sender. Making a note of process of message conveyed and how it was perceived.</p> <ul style="list-style-type: none"> ○ Identify the communication gap if any. ○ Discuss and conclude the communication framework importance ○ Discuss/reiterate how to make communication framework strong. <p>1. Role play to assess the understanding of building blocks of communication: (can be tapered to the core skills of diploma courses, following are just few of the examples)</p> <ol style="list-style-type: none"> a. Announcing the result of students in the class or b. Announcing the job placement of students (people, context, message, form of message) c. Discussing the guidelines of examination (listening skills) d. Listening to the weather forecast without seeing and making note of the listening ability (play video of weather forecast) – Assess based on how much the student is able to recall. <p>2. Run National geography/Discovery Video clip/subject related technical video clip on YouTube: Check:</p> <ul style="list-style-type: none"> ○ if the student has not understood what a speaker expressed ○ about work or safety related issues ○ seeking clarification or advice appropriately from colleague, customer, management or vendor
		<p>1. Voice/tone modulation: Showcase video Discussion:</p>

<p>Unit 3</p>	<p>Verbal communication</p>	<p>What was right?</p> <p>What was wrong?</p> <p>How it should have been better?</p> <p>2. Picture description activity (memory test): Class split into groups A, B C,D: (two or four groups of at least 5 people each): Teacher shows different picture to each group for three minutes. Now each group has to remember what was on the picture and discuss with each other, write down the elements on a piece of sheet and share it with the teacher. Group that remembers more will be the winner.</p> <p>Teacher to observe the body language of a student in the group, listening skills of a student, presentation skill, comprehension skill, content delivery skill, confidence level, team work. And reiterate the concepts, dos and don'ts, and discuss what could have been done better. (details of pictures will be given in the workbook)</p> <p>3. Telephonic conversation: Role play by a teacher: Call Airtel/Vodafone department and asking for the phone number portability process.</p> <p>After teacher demonstrates, teacher divides the class in to small groups of three people.</p> <ul style="list-style-type: none"> • Each group will be given a different telephone conversation assignment (samples will be provided in workbook). • Two people in the group pretend to converse over the phone, and the third person makes a note of right and wrong approaches during the communication.
<p>Unit 4:</p>	<p>Non-verbal communication</p>	<p>Body language</p> <p>Simon Says:</p> <p>Instructions and set up :</p>

		<p>1. Series of instructions to the group that are to be copied/reproduced. Start slowly and increase the pace</p> <p>2. State the following actions as YOU do them:</p> <ul style="list-style-type: none"> ○ Put your hand to your nose ○ Clap your hands ○ Stand up ○ Turn around ○ Touch your shoulder ○ Sit down ○ Stamp your foot ○ Cross your arms ○ Put your hand to your forehead – <u>BUT WHILE SAYING THIS PUT YOUR HAND TO YOUR NOSE</u> <p>3. Observe the number of group members who copy what you did rather than what you said.</p> <p>Outcome of this activity:</p> <p>Discuss how body language can reinforce/influence verbal communication and drive the importance of body language and how to work on it</p> <ul style="list-style-type: none"> • Email communication & Using technical jargons: <p>Sample letter writing as assignment to students. (list will be provided in the text book – Request, apology, job application and relevant email formats that are useful for students post diploma course)</p> <ul style="list-style-type: none"> • There will be at least one assignment that utilizes technical jargons in email communication.
<p>UNIT 5:</p>	<p>English - Reading Skills, Grammar & Vocabulary</p>	<ul style="list-style-type: none"> • Reading passage (Provided in workbook) • Reading passage from the text book • Comprehension: Passage & Conversation (will be provided in workbook) • Chunking words and reading activities
<p>Unit 6:</p>	<p>Communication tools</p>	<ul style="list-style-type: none"> • Email writing activities: Writing emails using email provider. Theme based email writing • Report writing assignment <p>Writing about a machinery tool/interior designing</p>

		<p>plan? Related to the diploma stream.</p> <ul style="list-style-type: none"> • Resume writing assignment • Data handling: Collecting data about machines/number of students passed out of college for last three years and creating graph about it. • Presentation: <ul style="list-style-type: none"> ○ About learning in the communication class ○ Concept presentation
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Course Assessment Strategies

Assessment Methodology

- a. Observation (role play activities, team activities, demonstration)
- b. Questions & Answer – Periodic Assessment

Assessment Grading RUBRICS

Language Basics	
Beginner	Doesn't know / understand
Intermediate	can read and identify commonly used words
Good	Confident , able to communicate well with known people
Advanced	Confident , able to communicate well with anyone using a English
Expert	Can read, understand; Also comprehend & can train others
Reading	
Beginner	Beginning to read, has native language impact
Intermediate	can read, identify words, build simple 3/4/5 letter words easily
Good	Can read, understand, build words, read simple sentences ; Also comprehend
Advanced	Can read, understand, build words, read simple sentences ; Also comprehend
Expert	Confident , read simple and complex sentences with punctuation, comprehend, spell also build words
Inter personal communication	
Beginner	is shy, doesn't talk/express
Intermediate	hesitates to communicate – due to lack of confidence / ability, can talk to known people
Good	can talk to unknown people, less confident, does not express, has hard time working as a team
Advanced	can talk to unknown people, confident, can't express, has hard time working as a team
Expert	confident, can talk to anyone, express well, works well in the team
Body language	
Beginner	Is shy, not open to communicate, has hard time making friends
Intermediate	Knows basics of Body language, practices sometimes
Good	Knows basics of Body language, practices most times, has less confidence in presenting content

Advanced	Knows and practices good body language all times, can present content
Expert	Knows and practices good body language all times, is an example, Leads the pack to get better
Listening Skills	
Beginner	Just hears, no attention
Intermediate	Listens, pays attention, does not ask any question
Good	Listens, pays attention, ask questions
Advanced	listens, pays attention, asks questions, cannot empathize
Expert	Listens, pays attention, asks clarifying questions, able to understand the message communicated
Acceptability to Learn	
Low	is not receiving to information
Average	receives information but resists to implement
Good , Above Average	receives information and implements per instructions
Strong	receives information and proactively implements and seeks feedback
Verbal Communication	
Beginner	Does not communicate, shy, low on confidence: has problem expressing in his/her native language or English language
Intermediate	Can communicate in native language, low confidence, shy, yet to try in English language
Good	Can communicate in native language, good confidence, tries to communicate in English language
Advanced	Can communicate in native language, express view points, good confidence, comfortable talking to people in the team, tries to communicate in English language as well
Expert	Can communicate in native language, express view points, very good confidence, can communicate with anyone without any fear, asks clarifying questions, communicates well in English, or tries hard to communicate in English language as well
Non-Verbal Communication	
Beginner	Struggles to understand the non-verbal cues, has to work on body language, has hard time understanding the written communication aspects
Intermediate	Can understand the non-verbal cues, has to practice, tries to apply written communication aspects
Good	Can understand non-verbal cues, practices well, works hard to get hold on written communication skills, exhibits confidence in whatever task is given
Advanced	Can understand non-verbal cues, can work on written communication aspects, exhibits confidence, practices well, help others to identify non-verbal cues
Expert	Can understand non-verbal cues, train others, confident, exhibits good non-verbal cues at all times, can train the pack, has good hold on written communication as well.

Comprehension	
Beginner	Tries to read the passage, has hard time to comprehend
Intermediate	Can read the conversation passage, has hard time understanding the regular passage
Good	Can read the conversation passage, regular passage, but stutters in answering questions if there are technical jargons
Advanced	Can read the conversation passage, comprehend but regular passage comprehension is good
Expert	Can read the conversation passage, comprehend but regular passage comprehension is good, explain better to others, help others, lead the pack
Writing Communication	
Beginner	Has trouble forming right sentences for written communication
Intermediate	Can form sentences, has problem with the layout, gets confused between layout for different form of written communication
Good	Can form sentences, has fair understanding of the layout to be used for particular type of written communication, but stutters for words and expression
Advanced	Can form sentences, has good understanding of the layout to be used for particular type of written communication, confident, can express thoughts well
Expert	Can form sentences, has good understanding of the layout to be used for particular type of written communication, confident, can express thoughts well and train others and lead the pack

Course assessment and Evaluation

Sl.No	Assessment	Time frame in semester	Duration (hrs)	Max marks	Conversion
1.	Pre assessment	Beginning of the course commencement	2	NA	NA
2	Skill Test - 1	At the end of 3 rd week	2	20	Average of three skill tests
3	Skill Test-2	At the end of 7 th week	2	20	
4	Skill Test-3	At the end of 13 th week	2	20	
5	Total Continuous Internal Evaluation (CIE) Assessment			60	60
6	Semester End Examination(SEE) Assessment - Practical mode (Written Test) + Student Activity		2+1=3	100 (75+25)	40
TOTAL					100

Recommended Learning Resources

<https://www.englishclub.com/grammar/parts-of-speech.htm>

Watch Amy Cuddy's TED Talk: [Your Body Language Shapes Who You Are](#)

Additional Reading: http://money.cnn.com/2000/05/03/career/q_body_language/

Pre-assessment:

Activity 1:

Make a group, read random words from the list, build sentence for few words from the list.

Create a group of 3 or 5 students. Randomly pick 5 words from the word list write down on the board/show them as a chart if you have created a word chart/make chart of words and ask them to pick one chart and READ the word.

Main idea: Testing the pronunciation ability, language ability, confidence in speaking, ability to understand and accept the instruction

Activity 2:

Simple reading test – Reading passages (Simple passage from the current course book)

Show the reading passage, let each one of them read 2 lines, after first student is done with reading two lines, then the next student must pick up from there and read next two lines. This process has to be followed until the entire class is done with reading or at least ten students are done with reading.

Main idea: Testing listening skills, attentiveness, language ability, pronunciation ability

Activity 3:

Students getting to know each other. Create a group of 3 or 5 students. Each student gets chance to talk to another student, introduce him/herself to the student, ask question, make a note of the answer against the name of the student who is answering the question on a sheet of paper.

Main idea: To assess current communication level, body language when students talk with each other, and confidence.

Commonly Used Word List

When	Today	For	Off	Yes	To	Girl	This
Give	Stop	There	Often	On	Am	A	Could
Again	Little	Than	Myself	Been	Where	You	Now
Do	Large	At	Over	Of	Way	Be	Fun
From	Both	Like	Along	He	Which	Were	Only
Him	Name	Said	Why	It	Write	Or	Much
Can	Few	They	Has	More	Goes	One	Tell
Go	Home	Look	Bring	My	Great	All	Out
But	Big	Know	Part	Any	Number		That Fast
Old	Should	Done	By	Their	First	Cat	Is
Not	Once	High	As	We	Find	His	Small
Her	Thought		So	She	Me	Have	Dog
Time	Better	Them	Away	Did	In	How	See
Long	Many	Does	No	Went	Before	Water	Here
Had	Get	Always	Other	Full	Saw	And	People
Word	Please	These	With	Some	Never	Use	School
Very	Ask	Last	An	Then	Boy	Take	Two
Your	Say	Got	What	If	Right	The	Call
Make	Ten	Next	Come	Night	After	Will	Might
Day	I	Those	Would	Made	About	Was	May
Each	Show	Play	Who	Up	Far	Are	Walk

To assess current communication skill: Activity based

Activity 3:

Making a group of students and getting to know each other with a predefined expectation for example:

Name:

I have performed on stage:

I'm good at sports:

I can speak more than 3 languages:

I'm always cheerful:

I like my mother tongue:

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20EE01P	Semester	I
Course Title	FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING	Course Group	Core
No. of Credits	4	Type of Course	Lecture & Practice
Course Category	PC	Total Contact Hours	6Hrs Per Week
			78Hrs Per Semester
Prerequisites	Basic Science	Teaching Scheme	(L:T:P)= 1:0:2
CIE Marks	60	SEE Marks	40

1. RATIONAL

Fundamentals of Electrical and Electronics Engineering is essential for all streams of diploma engineering to work in any industry as it covers basic electrical safety, troubleshooting and repairing of simple electrical systems. Basic knowledge of electrical wiring circuits, protective devices, electrical machines and basic electronics devices is required to work in any engineering field.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

1. Perform and test domestic wiring
2. Can operate electrical machine
3. Test different electronics devices

3. INSTRUCTIONAL STRATEGY

1. Instructor should expose to different learning tools used in respective labs, Operational safety and Procedure to be followed in the laboratory.
2. Instructor should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be skill and employability based.

4. COURSE OUT COMES

On successful completion of the course, the students will be able to

C01	Comply with the safety procedures
C02	Apply the fundamentals of electricity.
C03	Install and test electrical wiring system.

C04	Identify and Operate electrical machines, Batteries and UPS.
C05	Identify and test the different electronic devices.

5. COURSE TOPICS:

Unit No	Unit Name	Hours
1	Electrical Safety	6
2	Electrical Fundamentals	15
3	Protective Devices and Wiring circuits	15
4	Electric Machines and Batteries and UPS	15
5	Introduction to Electronic Devices and Digital Electronics	27
	Total	78Hr

6. COURSE CONTENT

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Sl No	Unit skill set (In cognitive domain) <i>On successful completion of the class, the students will be able to</i>	Topics/Sub topics	Practical	Hours L-T-P
UNIT-1 Electrical Safety				
1	Comply with the Electrical safety	1. Electrical Symbols 2. Electrical safety <ul style="list-style-type: none"> • Identify Various types of safety signs and what they mean • Demonstrate and practice use of PPE • Demonstrate how to free a person from electrocution • Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionary activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency • Inform relevant authority about any abnormal situation ➤ http://nreeder.com/Flash/sym	1. Electrical symbols related to electrical engineering. 2. Electrical safety	02-00-04

		bols.htm ➤ http://bouteloup.pierre.free.fr/iufm/as/de/house/safety.html		
UNIT-2 Electrical Fundamentals				
2	1. Identify and select the different measuring devices. 2. Identify different electrical supply systems 3. Identify open circuit, close circuit and short circuit conditions.	1. Describe the sources of electrical energy. 2. Electrical current, voltage, emf, potential difference, resistance with their SI units. 3. Mention the meters used to measure different electrical quantities. 4. Explain supply systems like AC, DC. 5. Describe open circuit, close circuit and short circuit ➤ http://nreeder.com/Flash/units.htm	1. Identification of measuring devices. 2. Measure current, voltage and analyses the effects of shorts and opens in series/parallel circuits.	1:0:2
3	Calculate basic electrical quantities	<ul style="list-style-type: none"> • Behavior of V, I in Series and Parallel DC circuits. • Relationship between V, I and R. ➤ http://nreeder.com/Flash/ohmsLaw.htm	1. Measure the voltage and current against individual resistance in electrical circuit. 2. Compare the theoretical values with actual in the circuit.	1:0:2
4	Connect resistances in different combination	1. Equation to find the Resistances connected in series 2. Equation to find Resistances connected in parallel 3. Resistances connected series and parallel combinations 4. Simple problems.	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	1:0:2
5	Calculate and measurement of different parameters of an AC quantity.	Ac sine wave: Sinusoidal voltage, current, amplitude, time-period, cycle, frequency, phase, phase difference, and their units. ➤ http://nreeder.com/Flash/freqPeriod.htm ➤ http://nreeder.com/Flash/oscilloscope.htm	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	1:0:2

6	1. Calculate and measure electric power and energy 2. Identify and differentiate Single phase and Three phase supply	1. Electrical work, energy, power and power factor <ul style="list-style-type: none"> • SI units • Mention the meters used to measure them 2. Single phase and Three phase supply ➤ http://nreeder.com/Flash/powerLaw.htm	<ul style="list-style-type: none"> • Measure the voltage, current, power and energy using relevant measuring instruments in a single-phase load. • Compare the theoretical values with actual in the circuit. • Measure the voltages in Single phase and Three phase supply. 	1:0:2
UNIT-3 Protective Devices and Wiring circuits				
7	Identify and select Protective Devices for given current and voltage rating	1. Necessity of Protective Devices 2. Various Protective devices and their functions <ul style="list-style-type: none"> • fuse wire, • Glass cartridge fuse • HRC fuse • Kit-kat fuse • MCB • MCCB • RCCB • ELCB • Relay 3. Earthing <ul style="list-style-type: none"> • Types • Pipe earthing • Plate earthing 	1. Identification and Selection of various protective devices 2. Inspection of their installation in the college building/public building.	1:0:2
8	Identify and select the various electrician tools	1. Different types of electrician tools and their function. 2. Describe various wiring tools. 3. State procedure of care and maintenance of wiring tools.	Identification and selection of different tools.	1:0:2
9	1. Identify and select Wiring systems for a given applications 2. Identify and select the cables used for different current and voltage ratings. 3. Draw the wiring diagram	1. Describe different types of wiring systems. <ul style="list-style-type: none"> • Surface conduit • concealed conduit • PVC casing capping 2. Wiring systems and their applications. 3. Describe the types of wires, cables used for different current and voltage ratings.	1. Identification and selection of different Wiring systems. 2. Wire up and test PVC Conduit wiring to control of 2 sockets and 2 lamps. 3. Wire up and test PVC Conduit wiring to control one lamp from two different places.	2:0:4

10	Estimate and plan electrical wiring	Explain Plan and estimate the cost of electrical wiring for one 3m × 3m room consisting of 2 lamps, 1 ceiling fan, 2 three pin sockets.	Prepare the estimation and plan	1:0:2
UNIT-4 Electrical Machines and Batteries and UPS				
11	1. Identify the types of transformer. 2. verify the transformation ratio.	Transformer <ul style="list-style-type: none"> • working principle • Transformation ratio • Types and applications with their ratings 	Connect the Single- phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	1:0:2
12	1. Start and run the induction motor. 2. Troubleshoot DOL/Star-delta starter and induction motor	1. Induction motor <ul style="list-style-type: none"> • Types Induction motor and applications • Difference between single and three phase motors • Necessity of starters for AC motors • Describe different types of starters and applications 2. What are different causes and remedies for a failure of starter and induction motor.	1. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-delta starter. 2. Troubleshoot the DOL/S tar-delta starter and induction motor	2:0:4
13	Select and test the battery for a given application	Battery <ul style="list-style-type: none"> • Types of batteries (Lead acid battery, lithium, sealed maintenance free (SMF) battery, Modular battery). • Selection criteria of batteries for different applications. • Ampere-Hour Capacity. • Efficiency 	Testing Condition of a Lead-acid battery	1:0:2
14	Select the size of the UPS for a given application	UPS <ul style="list-style-type: none"> • List the types and applications • Selection criteria of UPS • Sizing of UPS 	Sizing of UPS	1:0:2
UNIT-5 Introduction to Electronic Devices and Digital Electronics				
15	Identify and differentiate Conductors, insulators and semiconductors.	Compare Conductors, insulators and semiconductors with examples ➤ http://nreeder.com/Flash/resistor.htm	Identification of types and values of resistors-color codes. Determine the value of resistance by color code and compare it with multimeter readings.	1:0:2

16	Identify and test PN junction Diode	PN junction diode <ul style="list-style-type: none"> • Symbol • Characteristics • Diode as switch. • Types of diodes and ratings • Applications 	Identify the terminals of a Diode and test the diode for its condition.	1:0:2
17	Build and test bridge rectifier circuit	Rectifier <ul style="list-style-type: none"> • Need for AC to DC conversion • Bridge rectifier with and without C filter, • Rectifier IC. 	Construct and test bridge rectifiers using semi-conductor diode and rectifier IC. Compare the waveforms using CRO.	1:0:2
18	1. Identify and test Transistor 2. Build and test transistor as an electronic switch	Transistor (BJT) <ul style="list-style-type: none"> • Symbol • Structure • Working principle 	1. Identification of transistor terminals and test. 2. Construct and test the transistor as an electronic switch	1:0:2
19	1. Identify and test various Sensors and actuators.	1.Sensors <ul style="list-style-type: none"> • Concept • Types: Temperature, Pressure, Water, Light, Sound, Smoke, proximity Sensors, Flow, humidity, voltage, vibration, IR (Principle/working, ratings/ specifications, cost, and applications) 2.Actuators <ul style="list-style-type: none"> • Concept • Types and applications. • Relay as an actuator. 	1. Connect and test an IR proximity sensor to a Digital circuit. 2. Connect and test a relay circuit using an Opto-coupler. (Photo Diode & Transistor)	2:0:4
20	1. Identify and test different digital IC	<ul style="list-style-type: none"> • Comparison of analog and digital signal • Digital systems, examples. • Binary numbers, Boolean identities and laws. • Digital system building blocks: Basic logic gates, symbols and truth tables. • IC-Definition and advantages. 	<ul style="list-style-type: none"> • Test a Digital IC. • Identification and selection of suitable ICs for basic gates. • Verify NOT, AND, OR, NOR, EXOR and NAND gate operations (two inputs). 	2:0:4
21	Know the application of Microcontroller and PLC	<ul style="list-style-type: none"> • Microcontroller as a programmable device, and list of real-world applications. • PLC and Their applications. 	<ul style="list-style-type: none"> • Identify different application microcontroller. • Identify commercially available PLC and their specifications 	1:0:2
TOTAL				26-0-52=78 Hours

7. PRATICAL SKILL EXERCISES

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO	L: T:P Hrs.
1	1. Collect/draw standard prominent electrical symbols related to electrical engineering. 2. Identify Various types of safety signs and what they mean	1	1,4	1	0:0:2
2	<ul style="list-style-type: none"> • Identify Various types of safety signs and what they mean • Demonstrate and practice use of PPE • Demonstrate how to free a person from electrocution • Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. • Fire safety, causes and precautionary activities. • Use of appropriate fire extinguishers on different types of fires. • Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency • Inform relevant authority about any abnormal situation 	1	1,4	1	0:0:2
3	1. Identification Measuring devices <ul style="list-style-type: none"> • Ammeter • Voltmeter • Wattmeter • Ohmmeter • Digital Multimeter • Megger • Tong tester 2. Measure current, voltage and analyses the effects of shorts and opens in series / parallel circuits.	2	1,4	2	0:0:2
4	Measure the voltage and current against individual resistance in electrical circuit. Compare the theoretical values with actual in the circuit.	2	1,4	2	0:0:2
5	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	2	1,4	2	0:0:2
6	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	2	1,4	2	0:0:2
7	Measure the voltage, current, power and energy using relevant measuring instruments in a Single-phase load. Compare the theoretical values with actual in the circuit. Measure the voltages in Single phase and Three phase supply.	2	1,4	2	0:0:2
8	1. Identification and selection of various protective	3	1,4	3	0:0:2

	<p>devices.</p> <ul style="list-style-type: none"> • HRC fuse • Kit kat fuse • MCB • MCCB • RCCB • ELCB • Relay <p>Videos/Presentations/Discussion on different protective devices. 2.Inspection of their installation in the college building/public building.</p>				
9	<p>Identification and selection of different tools. Hands-on use of the tools for appropriate applications. Combination plier, Cutting Plier, Nose plier, screw driver set, line tester, Poker, Hand Drill, Power Drill, Concrete Drill, Megger, Earth tester, Continuity tester, crimping tool, wire cutter, Wire splicer, wire stripper standard wire gauge, soldering iron, wooden mallet, ball pin hammer, testing board</p>	3	1,4	3	0:0:2
10	<p>1.Identification and selection of different tools. Hands-on use of the tools for appropriate applications. Surface conduit</p> <ul style="list-style-type: none"> • concealed conduit • PVC casing capping <p>2.Wire up and test PVC Conduit wiring and practice control of 2 sockets and 2 lamps.</p>	3	1,4	3	0:0:2
11	Wire up and test PVC Conduit wiring to control one lamp from two different places.	3	1,4	3	0:0:2
12	Plan and estimate the cost of electrical wiring for one 3mx3m room consisting of 2 CFL 1ceiling fan, 2 three pin sockets.	3	1,4	3	0:0:2
13	Connect the Single- phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	4	1,4	4	0:0:2
14	Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/star-delta starter.	4	1,4	4	0:0:2
15	Troubleshoot the DOL/Star-delta starter and induction motor	4	1,4	4	0:0:2
16	Testing Condition of a Lead-acid battery	4	1,4	4	0:0:2
17	Estimate the UPS rating for a computer lab with 50 computers/domestic.	4	1,4	4	0:0:2
18	<p>1.Identification of types and values of resistors-color codes. 2.Determine the value of resistance by color code and compare it with multimeter readings</p>	5	1,4	5	0:0:2
19	Identify the terminals of a Diode and test the diode for its condition.	5	1,4	5	0:0:2
20	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the	5	1,4	5	0:0:2

	waveforms using CRO.				
21	Identification of transistor terminals and test. Construct and test the transistor as an electronic switch.	5	1,4	5	0:0:2
22	Connect and test an IR proximity sensor to a Digital circuit.	5	1,4	5	0:0:2
23	Connect and test a relay circuit using an Opto coupler. (Photo Diode & Transistor)	5	1,4	5	0:0:2
24	Test an IC. Verify the truth-table AND, OR, NOT logic gates.	5	1,4	5	0:0:2
25	Verify the truth-table NAND, NOR, EX-OR, EX-NOR logic gates.	5	1,4	5	0:0:2
26	1. Identify MCS-51 variants 2. Identify commercially available PLC and their specifications.	5	1,4	5	0:0:2
Total					0:0:52 =52Hrs

8.MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment	Cognitive Level R/U/A	Lecture & Practical Sessions in Hrs	TOTAL
CO1	Comply with the safety procedures	PO1, PO4	1-2	A	6	
CO2	Apply the fundamentals of electricity.	PO1, PO4	3-7	A	15	
CO3	Install and test electrical wiring system and protective devices.	PO1, PO4	8-12	A	15	
CO4	Identify and Operate electrical machines, Batteries and UPS.	PO1, PO4	13-17	A	15	
CO5	Identify and test the different electronic devices.	PO1, PO4	18-26	A	27	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Fundamentals of Electrical and Electronics Engineering	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

9. SUGGESTED LEARNING RESOURCES:

Reference Books:

1. ABC of Electrical Engineering by B. L. Theraja and A. K. Theraja, S Chand Publishers, New Delhi, 2014 Edition.
2. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Education India, 2012 Edition.
3. Electronic Devices and Circuits by I. J. Nagrath, PHI Learning Pvt. Ltd., 2007 Edition.
4. Basic Electrical Engineering by V. Mittle and Arvind Mittle, McGrawHill Companies, 2005 Edition.
5. The 8051 Microcontroller & Embedded systems using 8051 assembly and C (2nd Edition) – M.A. Mazidi, J.C. Mazidi & R.D. McKinlay ISBN: 81-317-1026-2
6. Programmable Logic controllers, W BOLTON

e-Resources

1. <https://www.youtube.com/watch?v=mc979OhitAg&list=PLWv9VM947MKi7yJ0FCfzTBXpQU-Qd3K>
2. <https://www.youtube.com/watch?v=CWulQ1ZSE3c>
3. en.wikipedia.org/wiki/Transformer
2. www.animations.physics.unsw.edu.au/~jw/AC.html
3. www.alpharubicon.com/altenergy/understandingAC.htm
4. www.electronics-tutorials
5. learn.sparkfun.com/tutorials/transistors
6. www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf
7. www.technologystudent.com/elec1/transis1.htm
8. www.learningaboutelectronics.com
9. www.electrical4u.com
10. <https://www.youtube.com/watch?v=zLW7TPf310>
11. <https://www.youtube.com/watch?v=8PTNjw-hQIM>

10. SUGGESTED LIST OF STUDENTS ACTIVITIES for CIE

Note: the following activities or similar activities for assessing CIE (IA) (Any one)

Each student should conduct different activity and no repeating should occur

1	Using suitable meters/ instruments give the practical working circuits to measure
2	Resistance, Current, Voltage, Power and Energy in DC and AC (Single phase) Circuits.
3	List out the different types of wiring systems used in your laboratories or house with their representation.
4	Mini-Projects: Like preparing extension box, switch box and wiring models,
5	List out the different protective devices used in your laboratories or house with their ratings.
6	Applications of Electro Magnetic Induction, statically induced and dynamically induced emf, self and mutual induced emfs.
7	Prepare a report on types of starters and enclosures used for various industrial applications of AC motors.
8	Types of Cells and Battery maintenance
9	Visit nearby Battery charging shop or show room and prepare a report of the visit.
10	Prepare a report on various types of diodes used for various industrial applications.
11	Prepare a report on various types of sensors and actuators used for various industrial applications.
12	Mini-Projects: Connect and test a sensor (domain application) to a Digital circuit

11. COURSE ASSESSMENT AND EVALUATION CHART

Sl.No	Assessment	Duration	Max marks	Conversion
1.	CIE Assessment 1 (Written Test -1-theory) - At the end of 3 rd week	60 minutes	20	Average of two written tests 20
2.	CIE Assessment 2 (Written Test -2-theory) - At the end of 13 th week	60 minutes	20	
3.	CIE Assessment 3 (Skill test) - At the end of 5 th week	120 minutes	20	Average of three skill tests 20
4.	CIE Assessment 4 (Skill test) - At the end of 7 th week	120 minutes	20	
5.	CIE Assessment 5 (Skill test) - At the end of 9 th week	120 minutes	20	
6.	CIE Assessment 6 (Student activity) - At the end of 11 th week	-	20	20
7.	Total Continuous Internal Evaluation (CIE) Assessment			60
8.	Semester End Examination (SEE) Assessment (Practical Test)	3 Hours	100	40
Total Marks				100

Note:

1. CIE written test is conducted for 20 marks (Two sections). Each section shall have two full questions of same CL, CO. Student shall answer one full question (10 marks) from each section.
2. CIE Skill test is conducted for 100 marks (3 Hours duration) as per scheme of evaluation and the obtained marks are scaled down to 20 marks

12. SCHEME OF VALUATION FOR SKILL TEST (CIE) & SEE**(CONTINUOUS INTERNAL & SEMESTER END EXAMINATION)**

Sl. No.	Particulars	Marks
1.	Identification of meters/ equipment/wires/tools etc.	10
2.	Writing Circuit/writing diagram and Procedure*	25
3.	Conduction	35
4.	Results	10
5.	Viva-voce	20
Total		100

12. RUBRICS FOR ACTIVITY

RUBRICS FOR ACTIVITY (Example only)						
Faculty need to develop appropriate rubrics for respective activity						
Dimension	Beginning	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	
Average / Total Marks:						

Lab Equipment Requirement

The following are the specification of the apparatus required for Applied Science lab and number of apparatus required for the batch of 20 students.

Sl. No.	Name of Equipment and Specification	Quantity Required
1	Dual Channel 30 V, 2 A continuously variable DC Regulated Power Supply with Current and Overload Protection	05 Nos.
2	+/- 15 V, 2 A, fixed DC Regulated Power Supply	05 Nos.
3	Portable Moving Coil DC Voltmeters a) 0 - 1 V b) 0 - 10 V c) 0 - 30 V	Each 05 Nos.
4	Portable Moving Iron AC Voltmeters a) 0 - 300 V b) 0 - 600 V	Each 05 Nos.

5	Portable Moving Coil DC Ammeters a) 0 - 100 mA b) 0 - 1 A c) 0 - 2 A	Each 05 Nos.
6	Portable Moving Iron AC Ammeters a) 0 - 2 A b) 0 - 5 A c) 0 - 10 A	Each 05 Nos.
7	Watt-meters a) 150/ 300V, 2 A, UPF b) 300/ 600 V, 5/ 10 A, LPF	Each 02 Nos.
8	Rheostats – 25 Ohms, 50 Ohms, 150 Ohms, 220 Ohms (all rated at 3 A)	Each 05 Nos.
9	Rheostat Loads s – 1 KW, 230 V	02 Nos.
10	Wire wound Resistors- 5 Ohms 2 Watts, 25 Ohms 5 Watts, 330 Ohms 2 Watts, 560 Ohms 2 Watts, etc.	Each 05 Nos.
11	Soldering Iron 60 W	05 Nos.
13	Single Phase Energy meter 10 A, 230 V, 50 Hz, Digital type	05 Nos.
14	Multi-meter Digital ¾"	06 Nos.
15	Dual Trace Oscilloscope – 30 MHz	02 Nos.
16	Three Phase Induction Motors :1 HP – 440 V 50 Hz, 2 HP – 440 V 50 Hz.	Each 02 Nos.
17	Three phase DOL, Star-Delta, Auto transformer starter	Each 02 Nos.
18	UPS 1 KVA	01 Nos.
19	Battery Lead-Acid type, 140 A-hr and Hydrometers	02 Nos.

Sl. No.	Name of Equipment and Specification	Quantity Required
20	I C Trainer kit	05 Nos
21	Digital IC's 7400, 7402, 7404, 7408, 7486 etc	Each 10 Nos.
22	Wooden Wiring board (2x3) ft	10
23	Wiring accessories	

2	<ul style="list-style-type: none"> a) PVC conduit - ¾" - 10 lengths b) Cap and casing - ¾" - 10 lengths c) Switches Single Pole- 5A, 230 V d) Switches two way – 5 A, 230 V e) 3 Pin Sockets 5A, 230 V f) Bulb Holders – 5 A, 230 V g) 3 Pin Plug 5A, 230 V h) 60 Watts Lamps i) 100 Watts Lamps j) 15 W CFL lamps k) Copper Wires of sizes 1.5 mm², 2.5 mm², 4 mm² – 1 coil each l) Gang boxes (1+1, 2+1, 2+2) m) Kit –Kat fuses 5A, 15 A n) MCB 16 A & 32 A/ 230 V, Single and Double Pole o) ELCB 16 A & 32 A/ 230 V, Double Pole p) Neutral link- 16 A, 230 V q) Screws of assorted sizes r) Testers 	Each 10 Nos.
24	<p>Electronic Components</p> <ul style="list-style-type: none"> a) Diodes - BY 127 and IN 4001 b) Zener Diodes – 6.2 V, 5.6 V, 7.8 V c) Relays – solid state Sugar cube type, SPST, Coil 6V, Power circuit 230 V, 5 A. d) Spring Boards e) Bread Boards f) Tag Boards. 	Each 10 Nos.
25	Simple PANEL BOARD/ CUBICAL consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.	1 No

Government of Karnataka
Department of Collegiate and Technical Education
Board of Technical Examinations, Bangalore

Course Code	20CE11T	Semester	I
Course Title	ENVIRONMENTAL SUSTAINABILITY	Course Group	Audit
No. of Credits	2	Type of Course	Lecture
Course Category	AU	Total Contact Hours	2Hrs Per Week
			26Hrs Per Semester
Prerequisites	Basic Environmental Science	Teaching Scheme	(L:T:P)= 2:0:0
CIE Marks	50	SEE Marks	No

COURSE OBJECTIVES:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control methods to solve domestic and industrial problems.
3. Use relevant water and soil control methods to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

COURSE OUTCOMES:

At the end of the course student will be able to know :

C01	Importance of ecosystem and terminology.
C02	The extent of air pollution, effects, control measures and acts.
C03	The extent of noise pollution, effects, control measures and acts.
C04	The water and soil pollution, effects, control measures and acts
C05	Different renewable energy resources and efficient process of harvesting.
C06	Solid Waste Management and Environmental acts.

COURSE CONTENT:

<i>Marks: 15</i>	Unit-1 Ecosystem	<i>Allotted Hrs: 03</i>
Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem. Global warming - Causes, effects, Green House Effect, Ozone depletion.		
<i>Marks: 20</i>	Unit-2 Air Pollution	<i>Allotted Hrs: 03</i>
Air pollution, Natural and manmade sources of air pollution, Effects of air pollution. Air Pollutants and Types. Control of air pollutants by Cyclone separator and Electrostatic Precipitator, Air (prevention and control of pollution) act 1981		
<i>Marks: 10</i>	Unit-3 Noise Pollution:	<i>Allotted Hrs: 02</i>
Noise pollution: sources of pollution, measurement of pollution level, Effects and Control of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000		
<i>Marks: 20</i>	Unit-4 Water and Soil Pollution:	<i>Allotted Hrs: 06</i>
Water pollution and Sources of water pollution, Types of water pollutants, Characteristics of water pollutants, control measures of water pollution. Definition and list unit operations in water and Waste Water Treatment process, Water (prevention and control of pollution) act 1974, Water conservation – Importance of Rain Water Harvesting. Soil pollution, Causes, Effects and Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides		
<i>Marks: 20</i>	Unit-5 Renewable sources of Energy	<i>Allotted Hrs: 07</i>
<i>Solar Energy:</i> Basics of Solar energy. Definition and advantages of advanced solar collectors. Solar water heater and Solar stills and their uses. <i>Biomass:</i> Overview of biomass as energy source. Thermal characteristics of biomass as fuel. <i>Wind energy:</i> Current status and future prospects of wind energy. Wind energy in India. Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy, Ocean energy resources, Tidal energy conversion.		
<i>Marks: 15</i>	Unit-6 Solid Waste Management and Environmental Acts	<i>Allotted Hrs: 05</i>
Solid waste generation, Sources and characteristics of Municipal solid waste, Solid Waste Management rules 2016- 3R in SWM. E- Waste generation, Sources and characteristics, E waste management rules 2016 Plastic Waste generation, Sources and characteristics, Recycled plastic rules 2016 Importance of Environment (protection) act 1986 Occupational health and safety measures.		

Unit No & Name	Detailed Course Content	CO	PO	Contact Hrs
1. Ecosystem	Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem.	CO1	1,5,7	1
	Global warming - Causes, effects.	CO1	1,5,7	2
	Green House Effect, Ozone depletion - Causes, effects	CO1	1,5,7	3
2. Air and Pollution	Air pollution, Natural sources of air pollution, Man Made sources of air pollution	CO2	1,5,7	4
	Air pollutants and Types, Effects of Particulate Pollutants and control by Cyclone separator	CO2	1,5,7	5
	Effects of Particulate Pollutants and control by Electrostatic Precipitator, Air (prevention and control of pollution) act 1981.	CO2	1,5,7	6
3. Water and Soil Pollution	Noise pollution: sources of pollution, Measurement of Noise pollution level.	CO3	1,5,7	7
	Effects and Control of Noise pollution. Noise pollution (Regulation and Control) Rules, 2000	CO3	1,5,7	8
4. Water and Soil Pollution:	Sources of water pollution. Types of water pollutants, Characteristics of water pollutants.	CO4	1,5,7	9
	Control measures of water pollution.	CO4	1,5,7	10

	Definition and list unit operations in water and Waste Water Treatment process, Water (prevention and control of pollution) act 1974.	C04	1,5,7	11
	Water conservation – Importance of Rain Water Harvesting	C04	1,5,7	12
	Soil pollution, Causes and Effects due to Fertilizers, Pesticides and Insecticides	C04	1,5,7	13
	Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides.	C04	1,5,7	14
5. Renewable sources of Energy	Solar Energy: Basics of Solar energy. Solar collectors and advantages of Advanced solar collectors.	C05	1,5,7	15
	Solar water heater, Solar stills and their uses.	C05	1,5,7	16
	Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel.			17
	Wind energy: Current status and future prospects of wind energy. Wind energy in India.	C05	1,5,7	18
	Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy	C05	1,5,7	19
	Environmental benefits of New Energy Sources- Ocean energy resources	C05	1,5,7	20
	Environmental benefits of New Energy Sources-Tidal energy conversion.	C05	1,5,7	21
6. Solid Waste Management And Environmental Acts	Solid waste generation, Sources, Characteristics of solid waste Solid Waste Management rules 2016	C06	1,5,7	22
	E- Waste generation Sources and characteristics, E waste management rules 2016	C06	1,5,7	23
	Plastic Waste generation Sources and characteristics, Plastic Waste Sources and characteristics	C06	1,5,7	24
	Recycled plastic rules 2016,Importance of Environment (protection) act 1986,	C06	1,5,7	25
	Occupational health and safety measures.	C06	1,5,7	26
Total				26

References:

(a) Suggested Learning Resources:

Books:

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.
4. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
5. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
6. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.

1. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07- 451871-8.
2. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
7. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
3. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
4. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
5. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)

(b) Open source software and website address:

- 1) www.eco-prayer.org
- 2) www.teriin.org
- 3) www.cpcp.nic.in
- 4) www.cpcp.gov.in
- 5) www.indiaenvironmentportal.org.in
- 6) www.whatis.techtarget.com
- 7) www.sustainabledevelopment.un.org
- 8) www.conserve-energy-future.com

Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to group of students for hand-on experiences
- Encouraging students to visit sites such as Railway station and research establishment around the institution.

Mapping of Course Outcomes with Programme Outcomes

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for CIE on cognitive levels		TOTAL
					R	U	
CO1	Importance Of ecosystem and terminology	1,5,7	R,U	03	02	02	04
CO2	The extent of air pollution, effects, control measures and acts.	1,5,7	R,U	03	03	02	05
CO3	The extent of noise pollution, effects, control measures and acts.	1,5,7	R,U	02	03	02	05
CO4	The water and soil pollution, effects, control measures and acts	1,5,7	R,U	06	03	02	05

CO5	Different renewable energy resources and efficient process of harvesting.	1,5,7	R,U	07	03	02	05
CO6	Solid Waste Management and Environmental acts.	1,5,7	R,U	05	02	04	06
Total Hours of instruction				26	30		

R-Remember; U-Understanding;.

Level of Mapping PO's with CO's

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Environmental Science	CO1	3	0	0	0	2	0	1
	CO2	3	0	0	0	2	0	1
	CO3	3	0	0	0	2	0	1
	CO4	3	0	0	0	2	0	1
	CO5	3	0	0	0	2	0	1
	CO6	3	0	0	0	2	0	1

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

Method is to relate the level of PO with the number of hours devoted to the CO's which maps the given PO.
 If $\geq 50\%$ of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3
 If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2
 If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1
 If < 5% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not-mapped i.e.; Level 0

Course Assessment and Evaluation Chart

Sl. No	Assessment	Duration	Max marks	Conversion
1.	CIE Assessment 1 (Written Test -1 - At the end of 3 rd week	80 minutes	30	Average of three written tests 30
2.	CIE Assessment 2 (Written Test -2) - At the end of 7 th week	80 minutes	30	
3.	CIE Assessment 3 (Written Test -3) - At the end of 13 th week	80 minutes	30	
4	CIE Assessment 4 (MCQ/Quiz) - At the end of 5 th week	60 minutes	20	Average of three 20
5	CIE Assessment 5 (Open book Test) - At the end of 9 th week	60 minutes	20	
6	CIE Assessment 6 (Student activity/Assignment)- At the end of 11 th week	60 minutes	20	
7.	Total Continuous Internal Evaluation (CIE) Assessment			50
Total Marks				50

Note:

1. Average marks of Three CIE shall be rounded off to the next higher digit.
2. Assessment of assignment and student activity is evaluated through appropriate rubrics by the respective course coordinator. The secured mark in each case is rounded off to the next higher digit.

MANDATORY STUDENT ACTIVITY: EACH STUDENT HAS TO SELECT ANY ONE OF THE LISTED

1. Students chose one thing to reduce at home each week and write journal entries about their successes and challenges implementing the change. In class, they form groups and create "Do You Know?" posters.
2. Students pretend they are architects, and come up with a series of design changes to make their school more environmentally friendly. They then grade their projects according to a rubric.
3. A presentation for Green Team Club members to introduce themselves and the purpose of their club. They explain how to use their new recycling bins, in the classroom and in the cafeteria.
4. Ever wonder what's in your school's waste? This hands-on activity helps students assess their school's waste in order to think of ways to reduce it. The results can be incorporated into the school's recycling plan.
5. How do we measure climate change? What activities contribute to climate change?
6. 6. Start a compost or worm bin. Composting is a hands-on way to learn about important life science concepts such as ecosystems, food webs and biodegradation. Students experience how worms and other decomposers recycle fruits and vegetable scraps into compost. Use the compost in your college garden! Have green team students make up a skit and present details about the new composting program to all classrooms. Have them make signs for the bins (compost, recycle, and landfill), monitor the waste collection at lunchtime, cart the food waste to the compost, and decide how and where the compost will be used.
7. Paint posters and decorate bulletin boards or the doors to the cafeteria with waste- free lunch messages to announce or support a waste-free event, and have students vote for their favorite poster.
8. Conduct a classroom audit to identify waste and look for ideas to reduce and reuse. Empower the student to set goals, search for solutions and review progress.
9. Go on a field trip. Visit your local landfill, recycling center, or a nearby composing facility where the students can see first-hand what is happening to waste, and learn about the lifecycle of waste and its affect on the environment.
10. Home energy audit:Have students make a list of all the appliances and light bulbs in their house. How much energy does their house use if all the lights are on for 4 hours per day? If their appliances are on for 2 hours per day? How much energy could they save if they switched to energy-efficient appliances or light bulbs?
11. Use recycled material in art projects:Recycled materials can make beautiful art projects such as jewellery, planters, and bird houses. Incorporating materials that would otherwise be thrown away into art projects can show your students how to find new uses for these items.
12. Life cycle :One way to show students what happens when you put something in the trash versus recycling or reusing the object is to do a life cycle analysis. This is a flow chart that shows the environmental impacts of an object, from extracting the raw materials to

decomposition and everything in between. When something is put in the trash instead of being reused or recycled, the life cycle assessment will show a bigger environmental impact. When something is reused or recycled, the environmental impact is less because raw materials don't need to be extracted to create something new.

**Model Question Paper
I A Test (CIE)**

Programme	:		Semester: I
Course	:		Max Marks : 30
Course Code	:		Duration : 1 Hr 20 minutes
Name of the course coordinator:			Test : I/II/III

Note: Answer one full question from each section. One full question carries 10 marks.

Qn.No	Question	CL	CO	PO	Marks
Section-1					
1.a)					
b)					
c)					
2.a)					
b)					
c)					
Section-2					
3.a)					
b)					
c)					
4.a)					
b)					
c)					
Section-3					
5.a)					
b)					
c)					
6.a)					
b)					
c)					